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AIMS VS PRIORITIES

A Critique of the National Electricity Plan 2023-2027

Acknowledgments

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Introduction

Energy sector plays a pivotal role in shaping a country's socio-economic landscape. With a burgeoning population, increasing energy demand, as well as increasing Variable Renewable Energy (VRE) resources planned to be connected to the electricity system—Pakistan needs a comprehensive approach towards energy management.

Presently Pakistan's power sector grapples with multifaceted challenges—notably the escalating circular debt, currently standing at around Rs. 2.3 trillion and projected to rise further[1]. Additionally, the overreliance on imported fuels such as coal, regasified liquefied natural gas (RLNG), and Residual Furnace Oil (RFO), along with inefficient operations of old power plants, contributes significantly to the high electricity tariffs borne by consumers. While the underutilization of efficient power plants, compounded by contractual obligations resulting in capacity payments, exacerbates the burden on consumers in terms of tariff escalation. In parallel, the underperformance of public sector distribution companies have become a burden on the national exchequer. Substantial financial losses of Rs. 166 billion have been recorded due to transmission and distribution inefficiencies, along with Rs. 263 billion due to low recoveries[2]. Issues related to governance, safety standards, and malpractices have also led to loss of lives, resulting in 161 fatalities including both employees and the public, highlighting the urgent need for reforms.[3]

These challenges within the power sector trace back to the short-sighted planning in the 1990s. Mostly the decisions were influenced by the need to plug the supply-demand gap. While the capacity additions in the power sector catered to the rising demand, a myriad of issues emerged including the mounting power sector debt, transmission and distribution losses, reliance on imported fuels, rising electricity prices, and eventually the current issue of surplus capacity.

In response to these challenges, Pakistan has introduced several policies and plans in the power sector to ensure supply security and reliability. For instance, the private power policy of 1994, the hydel policy of 1995 etc. The Alternative Renewable Energy Policy (AREP) was also introduced in 2019 that envisioned the development of an efficient, sustainable, secure, affordable, competitive and environment friendly power system while promoting indigenization of energy resources.

Premise on that, Pakistan introduced its first approved National Electricity Plan (NEP) for the period 2023-2027 that aims to achieve diversification, resilience, accessibility, self-sufficiency, financial viability, and sustainability in the power sector. The objective of this energy monitor is to holistically analyze the priority areas given in the NEP while highlighting gaps and inadequacies in the planning processes and strategies. Additionally, the monitor also underscores the importance of Integrated Energy Planning (IEP) while emphasizing the need of aligning policies with long-term goals of energy security, energy equity and environmental sustainability. Before dissecting the NEP, it is crucial to understand the historical context of key power sector policies and plans that have led to this point. This necessitates a concise examination of past power sector policies and their underlying objectives.

1 https://profit.pakistantoday.com.pk/2023/10/21/govt-to-devise-plan-to-reduce-rs2-3tr-circular-debt/

2 https://www.nepra.org.pk/M&E/PER/Distribution/PER%202022-23%20-%20DSICOs.pdf

3 https://www.nepra.org.pk/M&E/PER/Distribution/PER%202022-23%20-%20DSICOs.pdf

A comprehensive overview of key power sector policies and plans

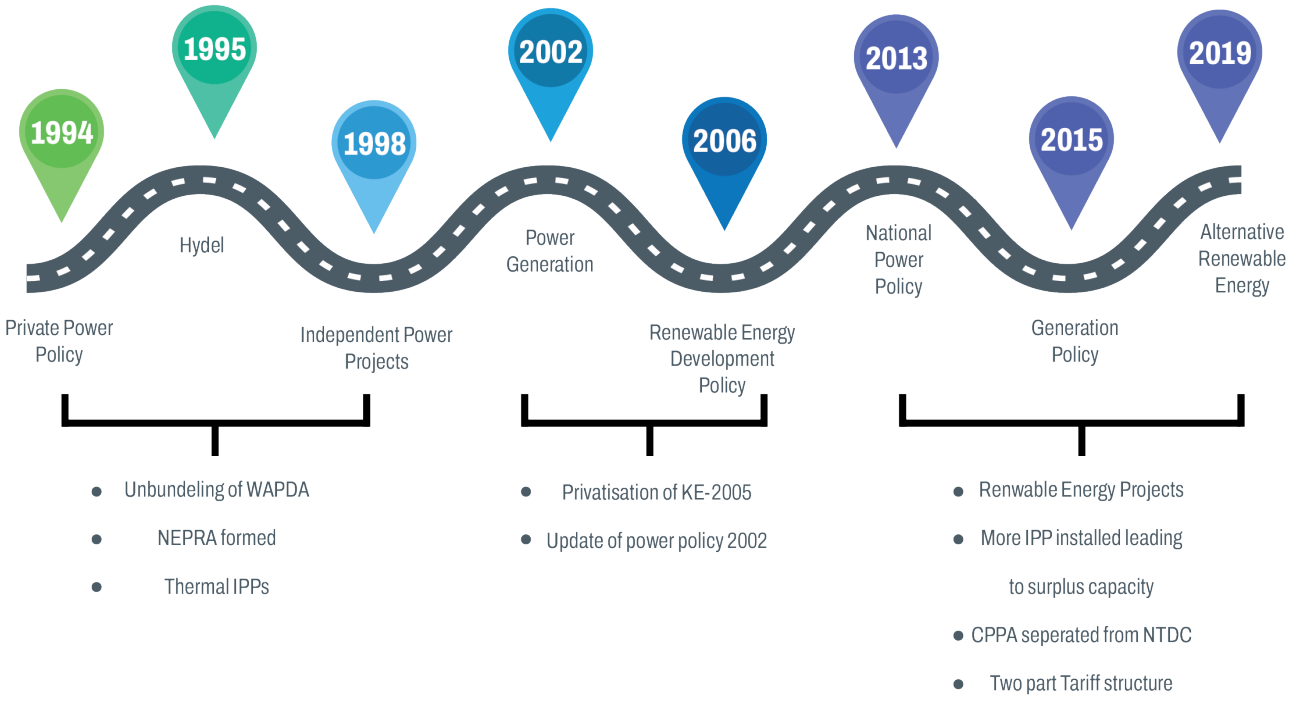
2.1- Brief historical overview

In the early 1990s, Pakistan witnessed severe power shortages largely owing to administrative negligence, a lack of timely infrastructure development, and a flawed pricing mechanisms [4]. The demand for electricity was escalating at a rate of 9-10% annually, outpacing the sluggish growth on the supply side. The Private Power policy of 1994 was then formulated with a key objective to expand generation capacity[5]. Within the scope of the policy, power sector generation was opened to private investors. A cost-plus tariff mechanism was introduced to make this market more lucrative for private investors—known as Independent Power Producers (IPPs). Further compensation to IPPs was tied to the exchange rate between Pakistani Rupee (PKR) and United States Dollar (USD). The introduction of the capacity charge was also a significant development in this policy framework, covering debt servicing, fixed operation and maintenance costs, insurance expenses, and return on equity (ROE). Furthermore, the energy price, based on the energy sold, was determined, with the government committing to pay a power purchase price comprising both, the energy purchase price, and the capacity charge. Overall, the 1994 policy represents a key milestone in Pakistan's power sector. While it facilitated the entry of the private sector into the power market, many components of this policy such as methodology based on cost-plus tariff, fixed return to the IPPs, indexation of exchange rate to USD, capacity payment charges etc are often cited as the starting point of the circular debt crisis. The larger objective of the government was to bring power plants online fast, and so they tried to incentivize the IPPs at the stake of long-term sustainability of the power sector.

4 https://macropakistani.com/pakistans-energy-enigma-a-historical-analysis/

5 https://nepra.org.pk/Policies/Power%20Policy%201994.pdf

The 1994 national power policy was then revised in 2002. The primary goals of this policy was to ensure the least cost power generation capacity and prevent capacity shortfalls. In this policy, additional tax incentives were introduced, and the responsibility for smaller generation projects was transferred to provincial governments. Additionally, fuel supply guarantees, previously provided under the 1994 policy, were eliminated.



[6] [7]Figure1: Key power sector policies 1994-2019

With the 1994 policy, and opening of the power sector to the private sector, the generation mix largely shifted toward costly fossil fuels. This dependence led to a significant rise in generation costs. The government then focused more on offsetting the large reliance on thermal and tapping the abundant indigenous renewable energy resources. In 1995 the government introduced the Hydel Policy, 1995. The policy facilitated concessions and power purchase arrangements for private projects, identifying preferred investment locations. Moreover in 2003, the government founded the Alternative Energy Development Board (AEDB), and in 2006, it issued the "Policy for Development of Renewable Energy for Power Generation This policy aimed to promote the adoption of renewable energy technologies (RETs) on a large scale. The policy aimed to incentivize private investors to establish small hydro, wind, and solar Photovoltaic (PV) plants, setting a target to achieve 10 percent of the generation mix from renewable energy resources[8]. However, both these policies were not very successful in bringing significant renewable energy projects online. Hydro projects encountered challenges like high capital costs, lengthy completion times, seasonal variations' impacts, transboundary water issues, and economic and political instability, leading to project delays and cost overruns. Also the scale of Renewable energy was low

6 https://www.researchgate.net/publication/354327120_Integration_of_Regression_Analysis_and_Monte_Carlo_Simulation_for_Probabilistic_Energy_Policy_Guidelines_in_Pakistan

7 https://www.sciencedirect.com/science/article/pii/S2352484722005996#section-cited-by

8 https://www.iea.org/policies/5376-alternative-and-renewable-energy-policy-2006-short-term-policy

under the 2006 policy during the time because it was not as competitive as conventional electricity generation. Even with tax breaks, renewable energy was still comparatively pricier due to high initial costs required to initiate the project. Also, government subsidies made crude oil energy cheaper, making renewable energy even less attractive.[9] [10]

In response to several critical challenges including the transmission and distribution (T&D) losses, electricity load-shedding, and the escalating circular debt, the National Power Policy of 2013 was then introduced. Key features of this policy included energy efficiency, minimizing theft, and reducing financial losses. The policy aimed to introduce competitiveness by transitioning from a single buyer to a buyer-plus market system, ending monopolistic trends. Premise on that, National Electric Power regulatory authority "NEPRA" mandated CPPA-G to propose competitive trading bilateral markets[11]. Further The Power Generation Policy 2015 was also introduced in parallel to boost generation capacity cost-effectively, building upon the 2002 policy. It focused on utilizing indigenous resources, ensuring fair competition, and environmental protection. A two-part tariff structure was introduced, including Energy Purchase Price (EPP) and Capacity Purchase Price (CPP). Public-Private Partnership was encouraged to attract private investment in the power sector. As a result, 7 IPPs based on imported coal and RLNG were established. In total, 35 thermal[12] IPPs with 16,541 MW capacity and 6 hydel IPPs with 484 MW capacity have been installed.[13]

Table#1 :Energy Deficit 2011-2016[14]

Year	Installed Capacity (MW)	Generation (MW)	Deficit (MW)
2016	25,300	20,200	-5100
2015	24,900	19,200	-5700
2014	23,800	18,800	-5000
2013	23,700	16,900	-6800
2012	23,500	15,900	-7600
2011	23,400	15,500	-7900

2.2- From past to present: Recent policies and plans

In recent years, there has been a global shift towards decentralized, democratized, and decarbonized energy systems, marking a significant transition in the global power sector. Pakistan, in line with this trend, introduced the Alternate Renewable Energy (ARE) Policy in 2019. This policy aimed to unlock the country's untapped renewable energy potential and drive the transformation of the power sector. Key objectives included increasing

9 https://www.sciencedirect.com/science/article/abs/pii/S1364032117312856
10 https://www.sciencedirect.com/science/article/pii/S2213138821002563
11 https://nepra.org.pk/Policies/National%20Power%20Policy%202013.pdf
12 https://www-pub.iaea.org/MTCD/Publications/PDF/cnpp2018/countryprofiles/Pakistan/Pakistan.htm
13 https://nepra.org.pk/Admission%20Notices/2021/06%20June/IGCEP%202021.pdf
14 https://journals.sagepub.com/doi/full/10.1177/01445987211064678#table1-01445987211064678

renewable energy generation to at least 20% by 2025 and at least 30% by 2030, promoting local manufacturing capacity, and replacing costly energy sources with more affordable renewables. In parallel, the iteration of Integrated Generation Capacity Expansion Plan (IGCEP) was launched in 2022, which lays out a generation capacity planning until 2031. By considering GDP for energy demand projections and generation costs for the optimal generation mix, the IGCEP aimed to align expansion with economic indicators . In contrast to the IGCEP's focus on GDP and generation costs, the National Electricity Plan, developed in conjunction with the National Electricity Policy of 2021, takes a broader approach.

The National electricity policy envisions to ensure universal access of electricity through a self-sustainable power sector, developed and premised on: optimal utilization of indigenous resources; integrated planning approach; efficient, liquid and competitive market design; and affordable & environment friendly outcome for the consumers.

3-National Electricity Plan (NEP) 2023:[15]

In accordance with the national electricity policy 2021, the Government of Pakistan presented a national electricity plan for the years 2023-2027, which aimed to bring short and long-term sustainability in the energy sector of the country. The plan broadly encompassed the attainment of five objectives i.e., diversification, resilience, accessibility, self-sufficiency, financial value ability, and sustainability. Under each objective, the plan has defined areas of priority which are further classified into specific strategic directives. In general, the plan has aimed for 100% electricity access to all by 2030 with indigenous energy resources constituting 75% of the generation mix by 2030.

Given the above-mentioned objectives of the current national energy plan and examining the lessons learned from previous plans, which were fraught with controversies and loopholes, we seek to identify whether this plan introduces any innovative approaches or falls prey to the persistent issues that have plagued past initiatives. In this energy monitor, our aim is to gain a clear understanding of the strategic architectures embedded in the objectives of NEP (2023-2027) and determine their efficacy in addressing the five defined objectives.

Analysis of the NEP Objectives

Diversification

This objective aims for diversification of energy systems in terms of infrastructure and primary fuel source. It intends to achieve this through promotion of distributed energy resources and development of an integrated energy plan, optimizing the energy inputs for the power sector. Of the integrated energy plan, till recently, only the generation expansion plan, "IGCEP" was publicly available which is a guiding document that primarily focuses on optimizing least cost generation sources. In this context, the NEP has laid out a set of additional assumptions to be considered in succeeding iterations of IGCEP. For instance, the provision of strategic projects as committed projects through a qualification criteria has been included. It states that the proposed strategic projects shall be evaluated, to be declared as committed in IGCEP, if they fall in at least one of the following categories

15 https://power.gov.pk/SiteImage/Policy/National%20Electricity%20Plan%202023-27.pdf

- security of energy supply;
- water – energy – food nexus;
- regional integration;
- municipal waste management.

Annexure 1 of the NEP also defines the process of approval of a strategic project, reviewing which, it appears the above categories adds an element of subjectivity as well in the approval of a strategic project. For example the federal government can classify a coal project as a strategic project under the category of "security of energy supply", whereas it has social and environmental implications. It also has the potential of conflict with another strategic objective of water-energy-food nexus, as coal mining involves dewatering, and disposal of untreated water harms the ecology. Hence, there is a need for making these categories more specific and considerate of environmental and socioeconomic externalities.

NEP also has to define a way to ensure that the outputs of any succeeding IGCEPs are truly on least cost basis and installed projects are in line with the results of the IGCEP. For example, an expensive Chashma C-5 nuclear plant has been recently inaugurated, in contradiction with the results of 2022 iteration of IGCEP.[16]

Another point states that "all the hydel generation shall be included in the definition of renewable energy". This means that hydel energy will be considered as renewable energy to meet the targets set for 2025 and 2030 under AREP. A negative impact of that will be the dilution of share of solar and wind energy under these targets, as hydel already enjoys a significant share in our generation mix. Hence, there is not only a need for specific defined targets for solar, wind, and hydel energy in the renewable energy targets under AREP, but also a deliberation on environmental and social implications of hydro projects such as big hydro. A more refined approach would be the characterization of hydro projects based on the scale and their potential socio-economic effects.

Resilience & Accessibility

In light of the clean energy transition, the second objective of NEP is to have a transmission system that can sustain the disturbances and contingencies in the power system. The priority areas defined under this section are transmission network expansion, robust distribution, system & market operators, electrification, and risk management & assessment.

As the share of renewable energy increases, the need for a resilient and robust transmission system becomes even more crucial. As our national grid is already aged and experiences recurrent breakdowns, it is important to consider the power quality issues that may emerge, with due consideration of strengthening the grid and improving the transmission capacity. The government already allocates funds for grid system upgrades in the Pakistan Sector Development Program (PSDP). However, the allocated funds are mismanaged, and a number of malpractices have been identified in the past on the part of respective DISCOs.

Another aspect discussed under this objective is a robust distribution system, mostly focused on infrastructure development. However, the critical need for transmission capacity expansion and the overhaul of the deteriorating transmission network spanning from north to south is not mentioned under this section. This oversight is the main challenge in our planning that needs to be overcome to narrow down the supply and

16 https://nepra.org.pk/Draft/IGCEP-2047%20along%20with%20Annexures.pdf

demand gap.

Instead, the focus of the NEP is towards debt recovery on the distribution side and not towards the grid and transmission system enhancement. Upgrading transmission infrastructure, implementing smart grid technologies, improving grid resilience and flexibility are crucial to reducing losses. Enhancing real-time monitoring and control systems is also vital for integrating cheaper generation resources into the grid. Unfortunately, this neglect has persisted due to a lack of monitoring and accountability, constraining the implementation of effective approaches. Therefore, the strategic interventions mentioned above will not achieve their intended impact until and unless there are tools to identify the impediments that restrict the application of these strategic interventions.

Figure:2 illustrates the existing conventional power grid system. In contrast to this, a smart grid (Figure 3) incorporates a diversification of supply sources.

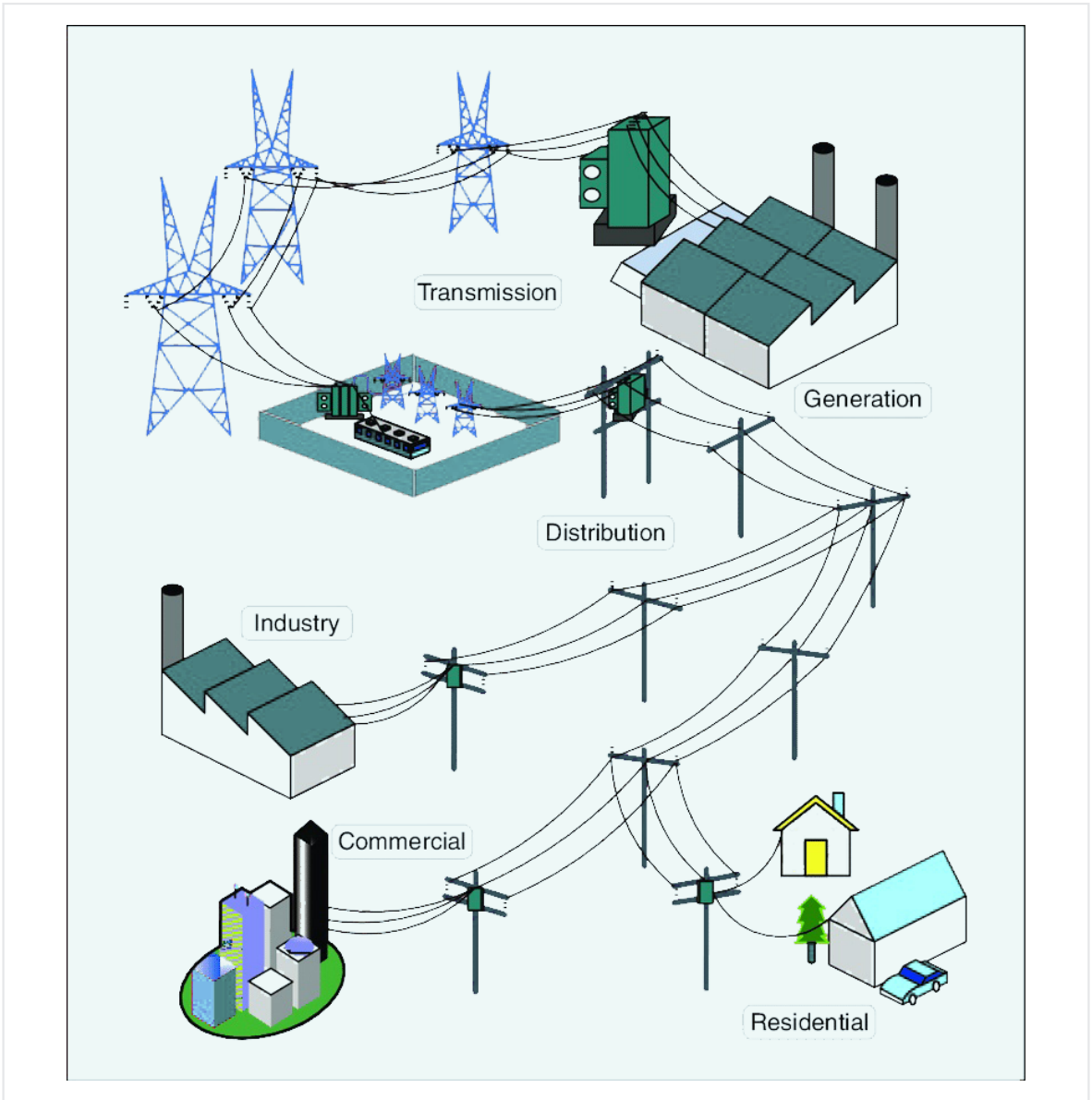


Figure 2: Conventional Grids

Figure 3: Smart Grids

Self-Sufficiency

The third objective encompasses the consideration of climate change, geo-politics, volatile energy markets and stresses on the indigenization of the generation resources and localization of technology.

Under the stressed need for localization of generation resources, indigenous coal from the fields of Thar is given prime importance. Despite the adverse environmental and socio-economic impacts of coal development in the region, and global shift away from coal, it is being favored for being an indigenous resource. This institutional bias towards coal is also depicted in the 2021 iteration of IGCEP, where the input costs of local coal are understated, and are starkly different from local coal cost estimates used by the LUMS Energy Institute in their generation planning exercise. Moreover, the mining costs related to coal extraction have been hidden under the variable operations and maintenance expenses in the IGCEP as fixed variable operations and maintenance expenses. This also raises concerns about IGCEP's credibility and cost-effectiveness.

It is important for our energy sector to be self-sufficient with protection from any international energy

market shocks and externalities. However, we need to take the path that is more sustainable and affordable, and is in the interest of a common citizen. While the NEP mentions consultation with relevant entities for impact assessment of proposed projects, it fails to account for social & environmental costs in the least cost assessment of projects which must be considered alongside technical parameters to ensure true impact evaluation on local communities.

Furthermore, political stability and a positive economic outlook are crucial for investor confidence in technology localization. Initiatives also need to be defined in this regard. The lack of bids for the 600 MW Muzaffargarh solar power plants, despite repeated request for proposals, attributed to regulatory and governance concerns, reflects waning investor interest, impacting foreign direct investment (FDI). Pakistan's low global ranking in ease of doing business further exacerbates challenges, affecting the country adversely.

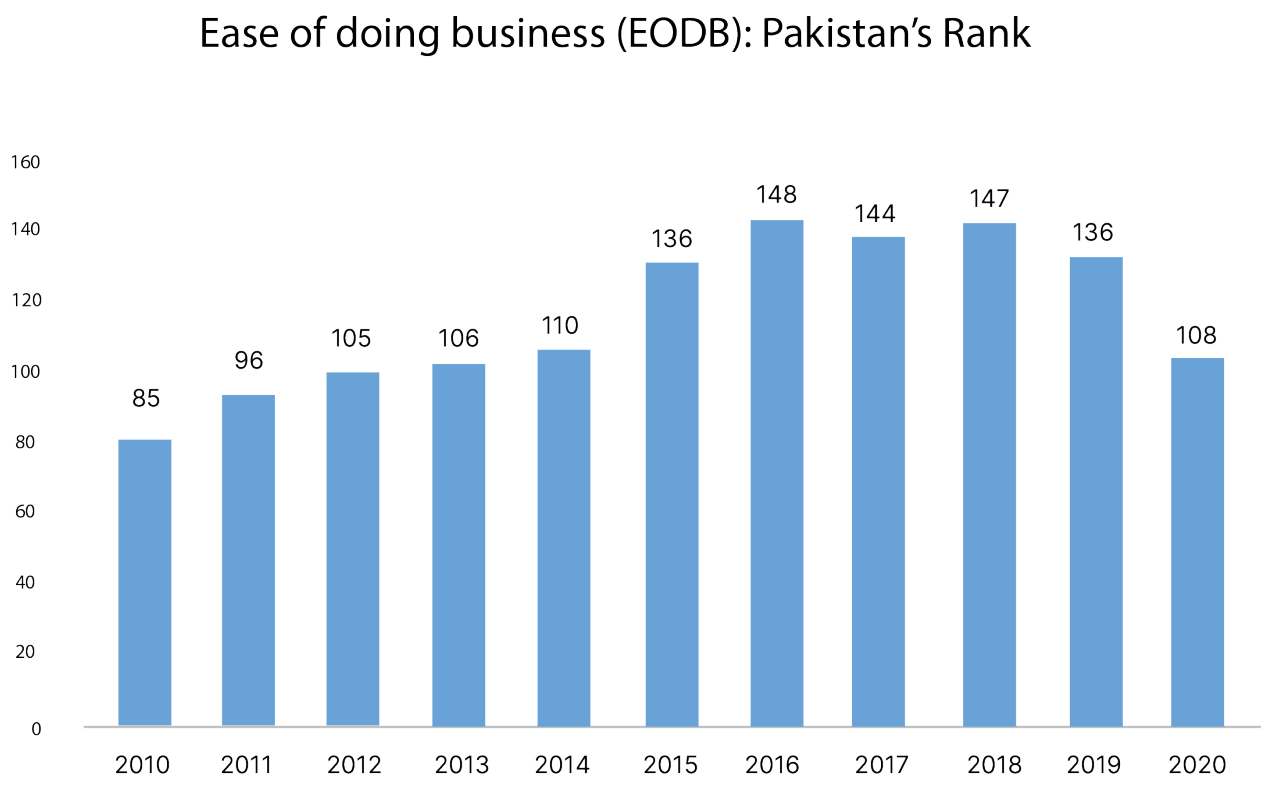


Figure 4: Source: Ease of Doing Business (EODB) Index SBP[17]

17 https://www.sbp.org.pk/FS/Ease/Ease-r.htm

Affordability

SDG #7 acknowledges access to affordable, reliable, and sustainable electricity as a fundamental human right. To achieve this, the NEP suggests:

1. Targeted subsidies for eligible consumer segments based on socio-economic preferences, transitioning to cost-centered tariffs.
2. Implementing decision-making based on system value to consider externalities.

To ensure the affordability of electricity for the common citizen, it is crucial to address the inefficiencies and exploitative practices of our Distribution Companies (DISCOs). In Pakistan, the majority of residential households consume less than 200 kWh annually, with a per capita usage of 438 kWh. However, rising electricity prices, exacerbated by economic challenges and subsidy withdrawals, have severely strained affordability for the lower strata of society. The cost-shifting due to increased net metered connections has further complicated matters for non-solarized consumers in DISCOs-serviced areas, widening the energy affordability gap.

Moreover, multiple DISCOs have engaged in unethical billing practices, with millions of consumers overbilled for periods exceeding 30 days. According to NEPRA's inquiry report, almost 10 million consumers were overbilled for the months of July and August 2023, highlighting the urgency for reform. This exploitative billing not only burdens consumers but also erodes trust in the power distribution company, undermining the entire sector. [18]

The NEP recognizes the need to extend subsidies, linking them to the provision of affordable electricity for protected consumers. For the next fiscal year, a significant discrepancy is anticipated between the demanded subsidy amount of Rs 1.23 trillion[19] and the government's proposed allocation, which only covers one-third of the demanded amount. This shortfall is likely to result in the remaining two-thirds being forcefully charged from residential, commercial, industrial, and CNG consumers, potentially exacerbating energy affordability issues and disproportionately affecting other consumer groups. These cross-subsidies are used to incentivize protected consumer groups by charging higher prices to other consumer groups creating disparity between the two. This undermines the objective of affordable electricity for all.[20]

18 https://www.nepra.org.pk/publications/NEPRA%20Excessive%20Billing%20Inquiry%20Report.pdf

19 https://tribune.com.pk/story/2460765/rs12tr-sought-for-power-subsidies

20 https://tribune.com.pk/story/2460765/rs12tr-sought-for-power-subsidies

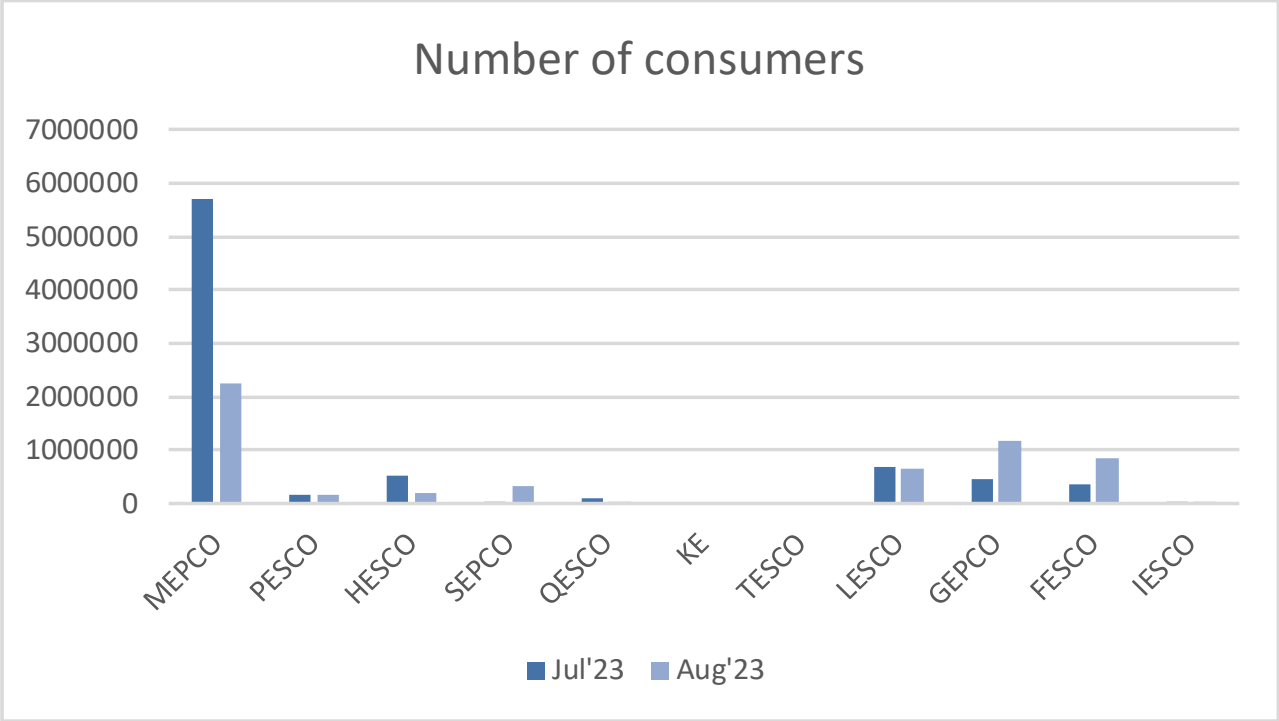


Figure:4 number of consumers under different DISCOs respectively July and August 2023

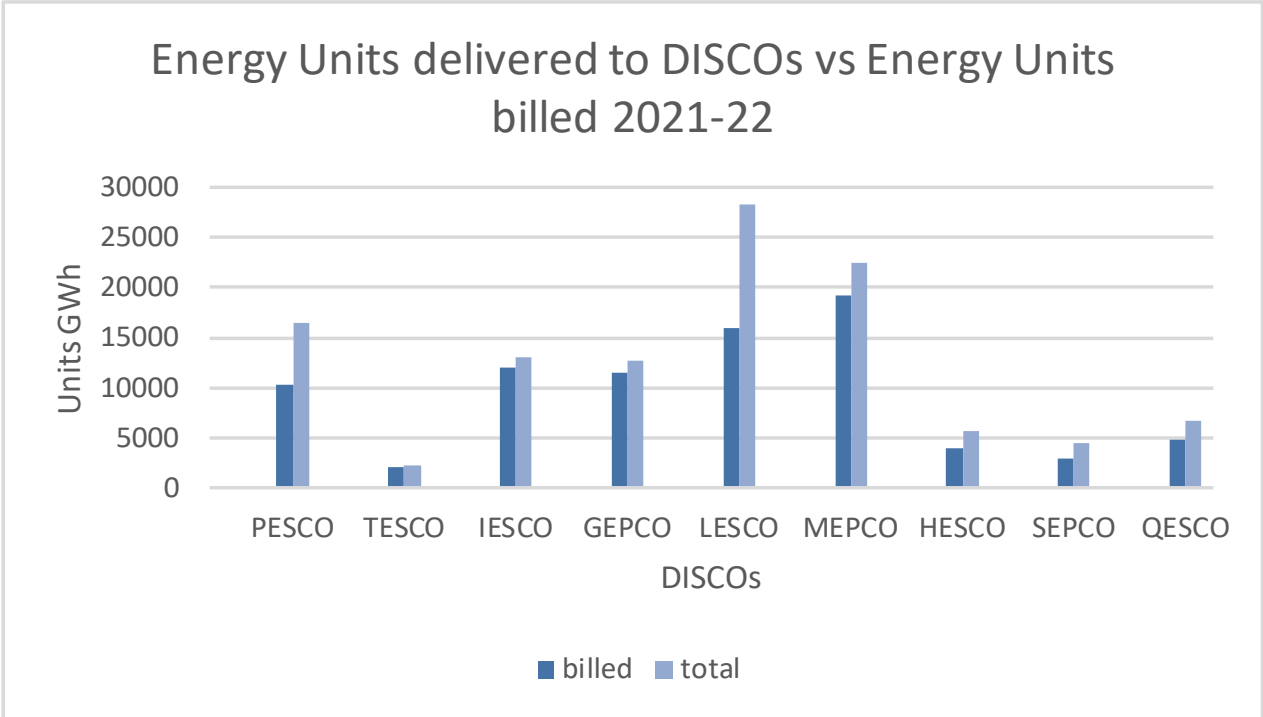


Figure:5 Energy units delivered to DISCOs Vs energy units 2021-2022[21] [22]

21 https://www.cppa.gov.pk/storage/uploads/downloads/FkNlXxFUeLpc6ZxYjkoYRUtQPbi2TZbkMX0PqmdJ.pdf

22 https://nepra.org.pk/publications/State%20of%20Industry%20Reports/State%20of%20Industry%20Report%202022.pdf

Financial Viability

The NEP also addresses the need for financial robustness of the power sector. Under this objective, it envisions an ecosystem that ensures cost recovery and reflection of true costs among consumer segments, along with transparent policies and frameworks. To achieve this objective, the NEP enlists following initiatives:

1. Revisiting consumer tariff structures with a focus on satisfaction and the sector's financial health.
2. Capping cross-subsidy contributions from productive consumer categories at 20% based on service costs.
3. Ensuring a fair market through uniform application of open access charges[23]. According to NEPRA, the national average power purchase price is Rs. 22.42/kWh, with capacity charges comprising Rs. 16.22/kWh and energy charge constituting Rs. 6.73/kWh.[24]

Open access charges are fees paid by users or consumers of electricity networks to network licensees. This can include costs related to the usage of the network itself (such as transmission and distribution costs), operator services (maintenance, management, and operation of the network), and expenses associated with market liberalization (the process of introducing competition into the electricity market).

The national electricity plan emphasizes tariff design as crucial for the financial sustainability and affordability of the power sector amid evolving techno-commercial dynamics. While the objectives aim to address critical components such as cost reflectivity, systemic flexibility, predictability of tariffs, and balanced allocation of costs, there are certain areas that warrant consideration.

The current two-part tariff system in Pakistan suffers from a lack of transparency, as evidenced by past instances of overbilling. NEPRA reports that the national average power purchase price is Rs. 22.42/kWh, comprising a substantial capacity charge of Rs. 16.22/kWh and an energy charge of Rs. 6.73/kWh. Consumer tariffs, burdened with taxes, surcharges, and adjustments, present a complex and inflated cost structure. Analysis of an average utility bill for a household in November 2023 reveals a stark disproportionality in the distribution of costs, with T&D expenses and taxes outweighing capacity charges. This skewed distribution not only masks underlying issues but also fuels a vicious cycle of escalating electricity prices, inadvertently deterring usage, and exacerbating issues like reduced demand and increased theft.

23 The Standby Charges for consumers availing open access (using transmission and/or distribution system of Licensee) and who draw power from the grid

24 https://nepra.org.pk/tariff/Tariff/Ex-WAPDA%20DISCOS/2023/TRF-100%20PPP%20REFERENCE%20%20FY%202023%2024%2014-07-2023%2018249-53.PDF

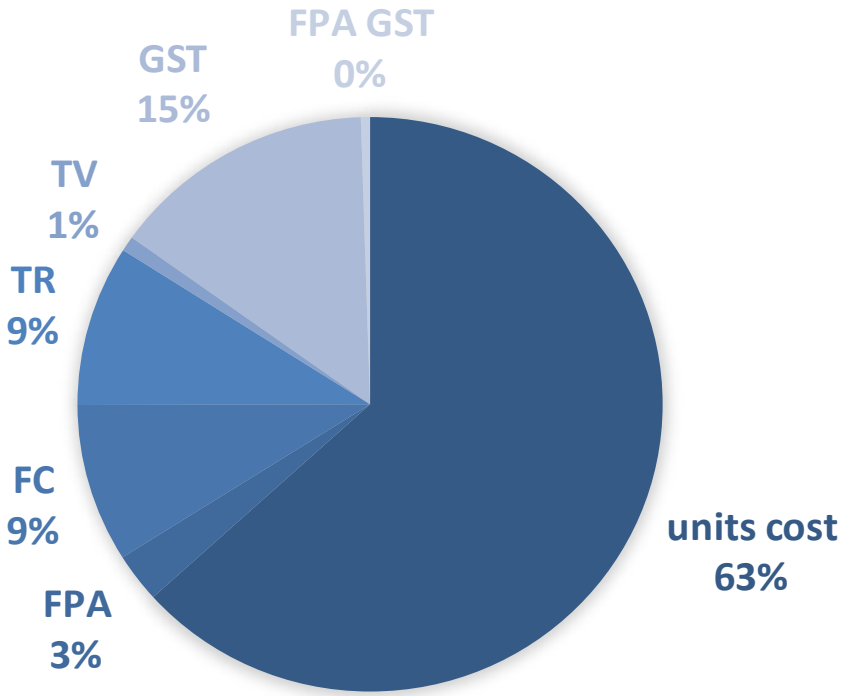


Figure 6: One month electricity bill for a 4-person household

To address these challenges, NEP advocates for a series of reforms. These include incorporating fixed charges, adjusting fuel prices, and transitioning from upfront tariff regimes to uniform tariffs, subject to periodic review every five years. Such measures are designed to stabilize revenue streams and bolster the financial stability of DISCOs. However, the success of these reforms hinges on ensuring equitable distribution of tariff adjustments, near-full billing collection and preventing undue burdens on consumers, particularly vulnerable low-income groups.

This section of the NEP also delves into the liberalization of electricity markets and the recovery of costs of existing infrastructure. It underscores the challenge of balancing financial viability, affordability, and competition within the sector. The plan outlines the framework for open access charges, aiming to promote competition and consumer choice. However, there is a need for careful scrutiny of the transparency and fairness of these charges, along with other safeguards to prevent any misuse. Regulatory oversight is deemed crucial for maintaining market integrity, but further details are needed on ensuring transparency and efficiency of the new mechanism.

Sustainability

The power sector is pivotal in balancing energy production and environmental sustainability, necessitating ongoing research, development, and adoption of digital technologies. In line with this, the NEP outlines a strategic plan, which encompasses:

1. Pakistan's Updated NDC 2021 targets a 60% shift to renewable energy, government-supported afforestation projects, and a 30% transition to electric vehicles.
2. Conducting a detailed assessment of the power sector's GHG emissions by July 2025.
3. Promoting energy efficiency and conservation through R&D, policy regulation, and incentive schemes to reduce energy intensity.
4. Establishing a central information system.
5. Increasing indigenous resource share to 60% by FY2025 and 75% by FY2030 in the national grid.

The NEP prioritizes decarbonization, aiming for 65% clean energy generation by FY 2030, aligning with the government's existing goal. However, Pakistan's renewable energy uptake faces significant barriers across economic, technical, institutional, and political dimensions. To effectively integrate Distributed Energy Resources (DERs) into the energy landscape, it is imperative to specify the exact proportion of solar, wind, and other renewable resources. This clarity is crucial for achieving the desired clean energy mix.

Moreover, DISCOs must eliminate biases in setting annual DERs targets and obtaining approvals, given past instances where a significant number of approved renewables were dropped from DISCOs' power acquisition programs, despite being included in the IGCEP for 2022-23 to 2026-27. This inconsistency undermines the credibility of the planning process.

Discrepancies exist within the NEP regarding quantifiable targets for solar and wind projects. Strategic Directive 91 aims for a clean energy share of 65% by FY 2030, while Strategic Directive 11.b.(ii) sets a target of 60% for the same period. This inconsistency necessitates clarification and alignment to ensure coherence and effectiveness in achieving renewable energy goals.

Under the same objective, the plan mentions assessing shadow costs of carbon emissions and potential internalization. It is also imperative that the NEP defines the term shadow cost for greater clarity. Currently, the NEP asserts for assessments of shadow costs of carbon emissions of the power sector in general, however the exercise should also be carried out for specific thermal projects (existing, committed, or candidates). This would ensure holistic costing in order to determine projects' feasibility and whether they should be pursued. The current approach, which delegates the decision to internalize shadow costs on a case-by-case basis subject to government approval, risks undermining the institutionalization of shadow costs in regulatory assessments. A uniform approach is recommended to maintain credibility and prevent strategic projects from being excluded.

Making shadow price assessments mandatory for each thermal project is essential for realizing their impact on consumers, the environment, and the government's decarbonization goals. Furthermore, the NEP overlooks Pakistan's significant methane emissions profile, ranking among the top 10 emitting nations globally. An authenticated emissions portfolio must be established, followed by mitigatory measures to address this critical issue.

The plan also outlines strategic objectives for achieving efficiency targets using demand-side management plans. However, the strategy to incentivize captive power plants with energy efficiency certification is misplaced. The actual need is to transition captive units from imported gas and diminishing local gas and incentivize industries to use grid electricity while ensuring uninterrupted power supply to run their processes. With 1,211 captive power units consuming about 415 MMcf of gas per day, this reliance poses efficiency challenges, operating at a significantly lower efficiency range of 30-38% compared to conventional power plants.[25] The current arbitrage for industries to use gas for inefficient captive power plants instead of electricity from the grid has indirectly led to decreased electricity demand, affecting the overall efficiency of the power sector and burdening consumers with higher electricity prices. Therefore, the plan's focus on energy efficiency certification for captive power plants distracts from the primary objective of transitioning these units to grid electricity. This approach may even perpetuate the existing inefficiencies, as industries may prioritize certification over actual efficiency improvements.

4.1- Integrated Energy Planning: A plausible solution

Having analyzed past initiatives and identified the shortcomings in the current National Electricity Plan, it is clear that previous inadequately planned strategies were fraught with controversies and loopholes. This realization directs our attention towards exploring the Integrated Energy Plan (IEP) as a comprehensive approach to optimize the balance of energy security, affordability, environmental sustainability, and socio-economic development. Since, integrated energy planning is the systematic analysis of all the factors that could influence the energy sector over the years. It is a power tool that coordinates assets effectively to where they are required the most. The objective of introducing the IEP in Pakistan is to enhance the analytical decision-making abilities of the Government of Pakistan, institutions, and key stakeholders. This implementation will empower the government to engage in strategic long-term development planning while also enabling effective medium- and short-term planning.

This integrated planning process is typically divided into three main components: generation planning, as outlined in the IGCEP, the Transmission System Expansion Plan (TSEP) and the Energy Resource Plan (ERP). The IGCEP is an annual document approved by the regulator each year, while the TSEP can cover periods of one, three, five, or ten years. In addition to these plans, the energy resource plan is a strategic framework that outlines how a region or country intends to manage and utilize its various energy sources to meet its energy demand. The availability of these three documents is essential for the effective development and implementation of IEP.

Although the National Energy Policy (NEP) highlights the Integrated Energy Plan (IEP) as a Priority Area 1 under its Diversification objective, several issues persist in the process. Pakistan's first Indicative Generation Capacity Expansion Plan (IGCEP) was approved in 2021; however, no Transmission System Expansion Plan (TSEP) was prepared in conjunction with it as mandated by the Grid Code. Consequently, there was a two-year gap without any new iterations of the IGCEP or TSEP. Recently, a new iteration of the IGCEP was released, accompanied by the TSEP.

To ensure the timely and effective formation of the IEP in light of the current energy crisis, it is crucial that the TSEP and Energy Resource Plan (ERP) are developed and disseminated within strict deadlines. This

25 https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/012821-pakistan-aims-to-divert-gas-from-captive-power-plants-to-residential-consumers

necessitates not only the implementation of clearly defined targets but also enhanced coordination among all relevant power sector stakeholders, including power generators, the National Electric Power Regulatory Authority (NEPRA), the National Transmission and Despatch Company (NTDC), and the Central Power Purchasing Agency (CPPA). Such coordination is essential for the seamless development of a comprehensive, integrated power sector plan.

Figure 7 emphasizes the key variables that should be considered while developing an integrated energy model for electricity generation and distribution. Before devising any plan, the authorities must be aware of the resources available and as to how far they can be exploited. The plan should adhere to any interventions while ensuring flexibility at all times. In addition to this, the output of an IEP model must reflect a consumer centric approach ensuring energy security of supply, energy accessibility, job creation and energy efficiency.

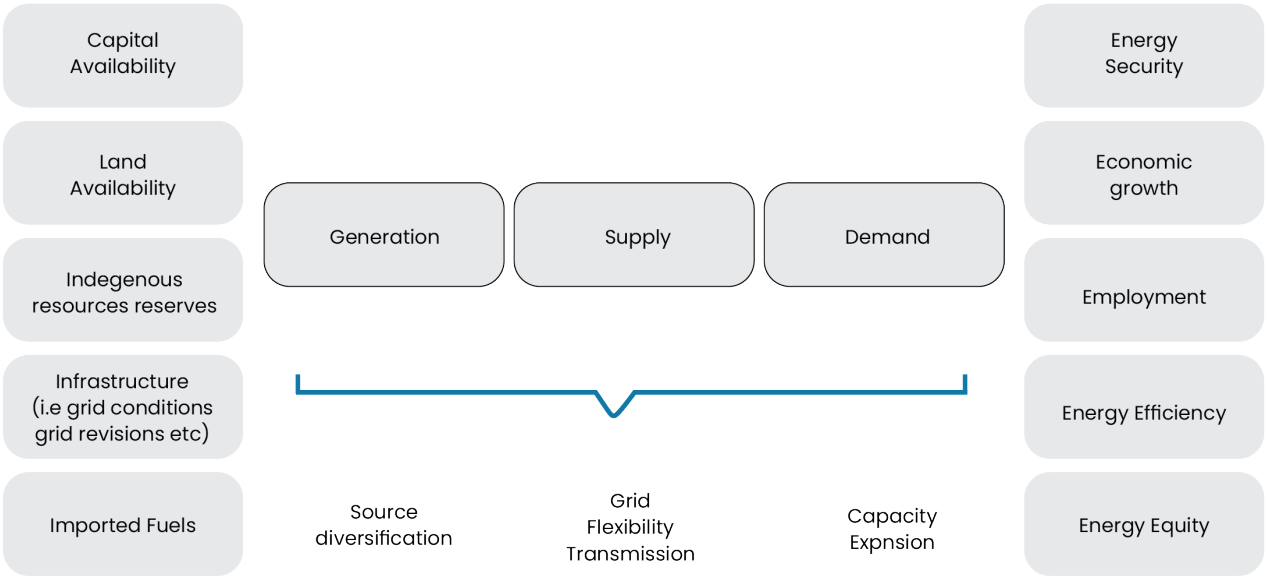


Figure 7: Key Elements for an Integrated Energy Model (Source: Author)

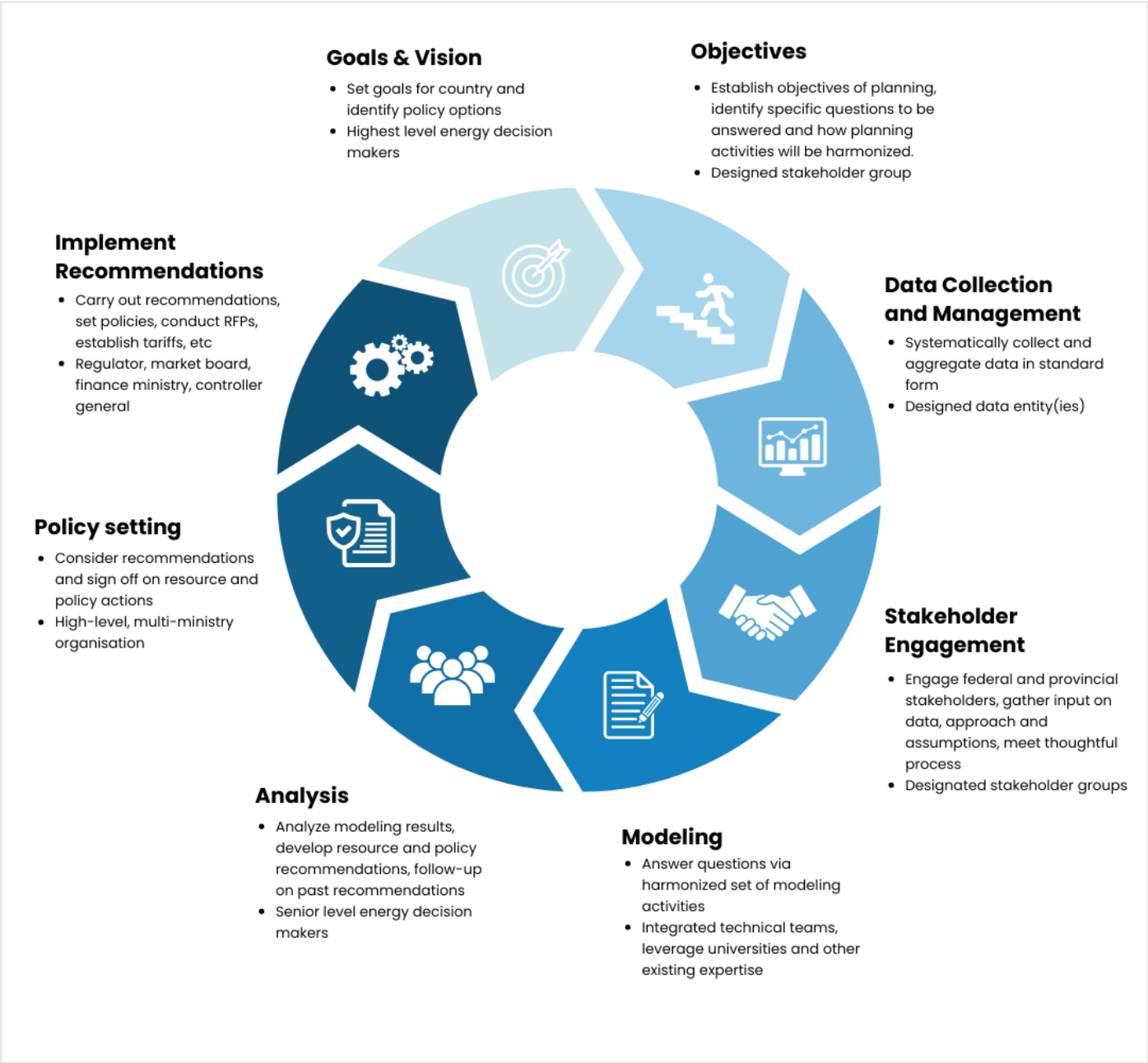


Figure 8: IEP Process (Source: https://www.pc.gov.pk/uploads/report/IEP_Report_FINAL.pdf)[26]

4.2- Conclusion

The NEP presents a comprehensive framework for addressing Pakistan's energy challenges, but a closer examination reveals several areas that require refinement and improvement. Its strategic objectives and initiatives require more clarity, specificity, and coherence to effectively address the complex issues of energy security, energy equity, and environmental sustainability.

Firstly, the National Electricity Plan aims to diversify energy systems but prioritizes strategic projects as committed projects over actual least-cost capacity additions. Broad project categories and including hydel in renewable energy may overshadow solar and wind. To improve, the plan should narrow strategic projects, focus

26 https://www.pc.gov.pk/uploads/report/IEP_Report_FINAL.pdf

on least-cost outputs, set clear targets for solar, wind, and hydel, and assess environmental and social impacts of hydro projects.

Building on diversification, the NEP seeks to enhance the resilience of the transmission system to withstand disturbances. This includes an emphasis on transmission expansion, distribution, system operations, electrification, and risk management. The plan's current focus on debt recovery over grid enhancement and its neglect of smart grid technologies and flexibility pose challenges. The NEP should prioritize transmission upgrades and grid resilience while following established guidelines for effective monitoring and evaluation.

The focus on self-sufficiency in generation resources and technology localization forms the third objective of the NEP. Local coal takes prime importance under the NEP for the need of self-sufficiency but this lacks consideration for environmental and socio-economic risks associated with coal development. NEP must prioritize sustainable and affordable generation options such as solar and wind which are naturally abundantly available in Pakistan. Furthermore, there is a need to enhance investors' confidence, which can be done by improving governance and creating a conducive business environment. Through a stable economic and political environment, both local and international investments can be attracted for our power sector projects.

In line with the Sustainable Development Goals (SDG #7), the NEP's fourth objective emphasizes providing affordable electricity through targeted subsidies and data-driven decision-making. However, inefficiencies and unethical billing practices by DISCOs, rising electricity prices, and inadequate subsidies present hurdles. The plan must ensure DISCOs operate transparently and adhere to guidelines, improve billing systems, and allocate sufficient subsidies to guarantee fair and affordable electricity for all consumers.

On the financial viability front, the NEP aims to stabilize the power sector by revising tariff structures, capping subsidies, and promoting fair markets. Current tariffs lack transparency and are inflated, leading to disproportionate cost distribution. Proposed reforms include fixed charges, fuel price adjustments, and uniform tariffs. Success depends on equitable tariff adjustments, full billing collection, and avoiding undue burdens on consumers.

The final objective of the NEP is to set and achieve sustainability and decarbonization goals. This includes boosting indigenous resources to 60% by FY2025 and 75% by FY2030, promoting energy efficiency, and establishing a central information system. Challenges include barriers to renewable energy, unclear renewable resource proportions, biases in distributed energy targets, discrepancies in solar and wind goals, and overlooked methane emissions. The plan should clarify renewable resource proportions, align solar and wind goals, internalize shadow costs, and transition captive power plants to grid electricity.

In conclusion, the NEP presents a comprehensive strategy for balancing diverse energy goals with resilience, self-sufficiency, affordability, financial stability, and sustainability. Seamlessly integrating these objectives is essential for the NEP to pave the way for a sustainable, efficient, and equitable energy future for Pakistan. The implementation of NEP also has to be ensured in order to realize the targeted improvements in the power sector. For it to become a guiding document for change and necessary transitions in the power sector, accountability measures must be set in place and followed, unlike the skewed past power sector policies and plans.

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Annexure:

Table 2: Thermal Power plants operating as IPPs under private power policy 1994[27] [28] [29]

IPP	Capacity (MW)	COD	Technology	Retired/In service
Lalpir Ltd.	362	1997	Oil-Fired Steam Turbine	In service
Gul Ahmed Energy Ltd.	136	1997	Diesel Engine	Terms of PPA were 22 years
Kohinoor Energy Ltd.	131	1997	Diesel Engines	In service
Tapal Energy Ltd.		1997	Diesel Engines	Terms of PPA were 22 years
Pak Gen.(Pvt) Ltd.	365	1998	Oil-Fired Steam Turbine	In service
Saba Power Company Ltd.	125	1999	Steam Turbines	In service
Rousch (Pakistan) Power Ltd.	450	1999	Combined Cycle	In service
Southern Electric Power Company Ltd.	117	1999	Diesel engines	In Service
Fauji Kabirwala Power Company	157	1999	Combined Cycle + Steam Turbine	In service
Habibullah Coastal Power Ltd.	140	1999	Combined Cycle	In Service
Japan Power Generation (Pvt) Ltd.	120	2000	Diesel Engines	In service
Uch Power Ltd.	586	2000	Combined Cycle	In service
Altern Energy Ltd	29	2001	Gas Fired Diesel Engine	In service
Liberty Power Project	225	2001	Gas	In Service

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28 https://www.ppib.gov.pk/kohinoor.html

29 https://www.semanticscholar.org/paper/Reconsidering-the-Power-Structure-of-Pakistan-Kamran-Mudassar/6dcc2310b4c32147d61e8ded95c917c862cc5484

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