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# Pakistan's Capacity–Flexibility Mismatch: Aligning Resources with Varying Electricity Demand

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## Executive Summary

Pakistan's power sector challenge is no more the supply centric instead turning installed capacity as dependable and affordable electricity. As of March 2026, Pakistan's total installed capacity had reached 49,651 MW which also included 7,319 MW of net-metered solar. However, consumers' sufferings are not over due to high tariffs and unreliable supply. This demonstrates a mismatch between capacity and system requirement. Electricity must be available when and where it is needed and responsive to changes in demand, generation, and network conditions. Daytime demand has significantly reduced by solar PV, while evening ramp is now new trend grid need to handle. Pakistan, therefore, needs to value not only electricity and contracted capacity, but also the verified services required to keep the system balanced and reliable.

This Policy Viewpoint recommends a phased, technology-neutral, contract-aware flexibility and ancillary-services mechanism building on Grid Code, Market Commercial Code, CTBCM and ISMO's operating role. The process should begin with a national flexibility-need assessment, followed by a NEPRA-authorized pilot covering two or three clearly defined services. Assessment of existing power plants; aggregated distributed resources should be undertaken for their eligibility to satisfy the common performance standards. The verified service payment mechanisms should be designed to avoid any duplicate payment under existing agreements. The process should only be expanded if an independent assessment provides lower total system costs, more reliability, better use of existing assets, and measurable consumers benefits.

**Core policy proposition:** Pakistan should transition from counting installed megawatts to acquiring verified flexibility through phased, technology-neutral, contract-aware system that rewards availability and performance while safeguarding consumers from overlapping financial costs.

## 1. From Surplus Capacity to a Flexibility Challenge

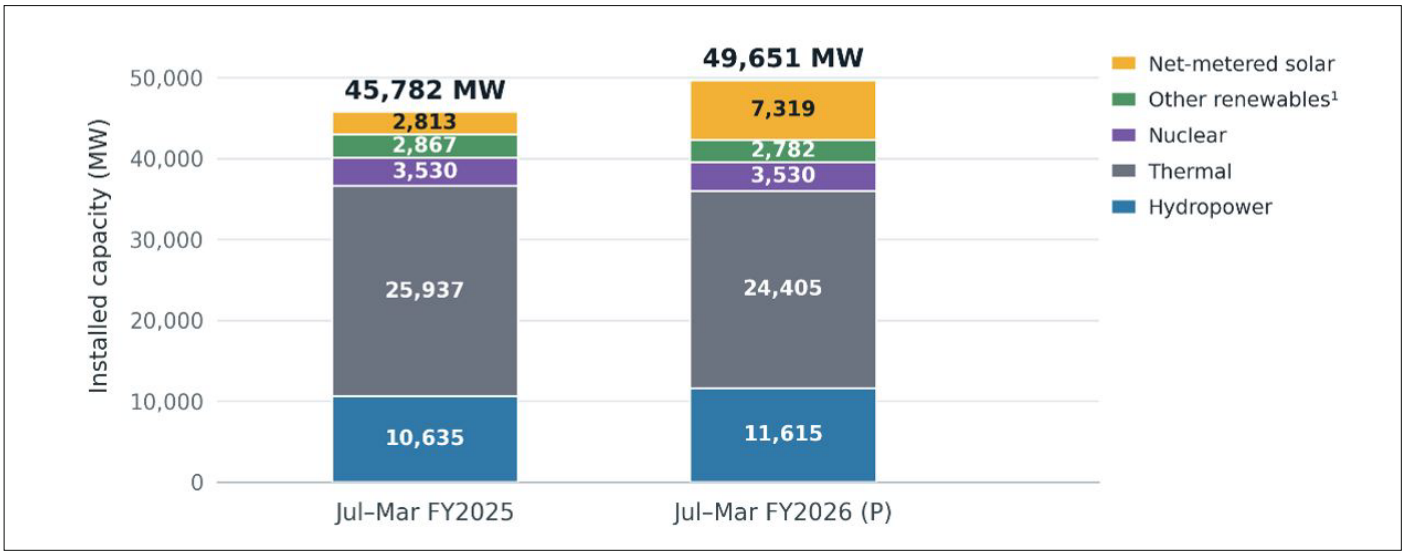
Pakistan's power sector has moved through two distinct eras. Decades of electricity shortages followed by successive IPP polices and CPEC projects which added significant megawatts. These interventions helped to address significant capacity shortages; however, the nature of the challenge has subsequently changed. Much of the system was developed under long-term contracts based on projection of rising grid demand, and consistent fuel supplies,. Here embarks era of surplus megawatt. The grid electricity sales are now below the forecasted expectation, as high tariffs, and rapid growth in self-generation through rooftop solar have reduced

consumption, leaving fixed costs to be recovered from a diminished pool of consumers.

The ever-varying capacity mix complicates the challenge. Between July–March FY2025 and the corresponding period of FY2026, reported renewable capacity increased from 5,680 MW to 10,101 MW, largely because net-metered solar rose from 2,813 MW to 7,319 MW. This increase, however, does not reflect firm dispatchable capacity.

Renewables First estimates approximately 38 GW of distributed solar capacity by June 2025, encompassing net-metered, behind-the-meter and off-grid systems (Renewables First, 2026). This broader estimate overlaps with registered net-metered capacity and should not be added in full to the reported installed-capacity total. The total reported installed capacity reached 49,651 MW by March 2026, while the Economic Survey separately identified thirteen closed IPPs representing approximately 5.1 GW (Finance Division, 2026). These closed units are not assumed to be available for dispatch or flexibility services. Most of these are ageing furnace-oil units whose contracts have expired or have been terminated, and they should not be read as capacity waiting to be recalled. These figures demonstrate why installed megawatts cannot be considered equally useful. Rooftop solar, reservoir hydropower, and fuel-constrained thermal generation differ in their availability, reliability, and ability to provide electricity to where it is required.

**Figure 1: Pakistan's Installed Generation Capacity Mix**




Source: Authors' construction based on Finance Division, Pakistan Economic Survey 2025–26, Table 14.1. Renewable capacity includes net-metered solar—2,813 MW in March 2025 and 7,319 MW in March 2026. Other renewables = reported renewable capacity less net-metered solar. FY2026 figures are provisional"

The installation of net metered and behind the meter solar is affecting the daily demand pattern of the national grid. It reduces grid demand during the day, especially around midday, but demand surges in the evening when solar output declines. This pattern creates operational difficulties for the power system and the evening ramp requires the demand to be meet from the resources that can respond quickly.

ISMO's metered hourly grid-demand data for FY2024–25 (1 July 2024–30 June 2025 excluding K-Electric, show substantial variation across months and hours (ISMO, 2025a). Table 1 summarizes monthly recorded demand and afternoon-to-evening increases.

## Table 1: Monthly Metered Grid Demand and Afternoon-to-Evening Increases, FY2024–25, Excluding K-Electric

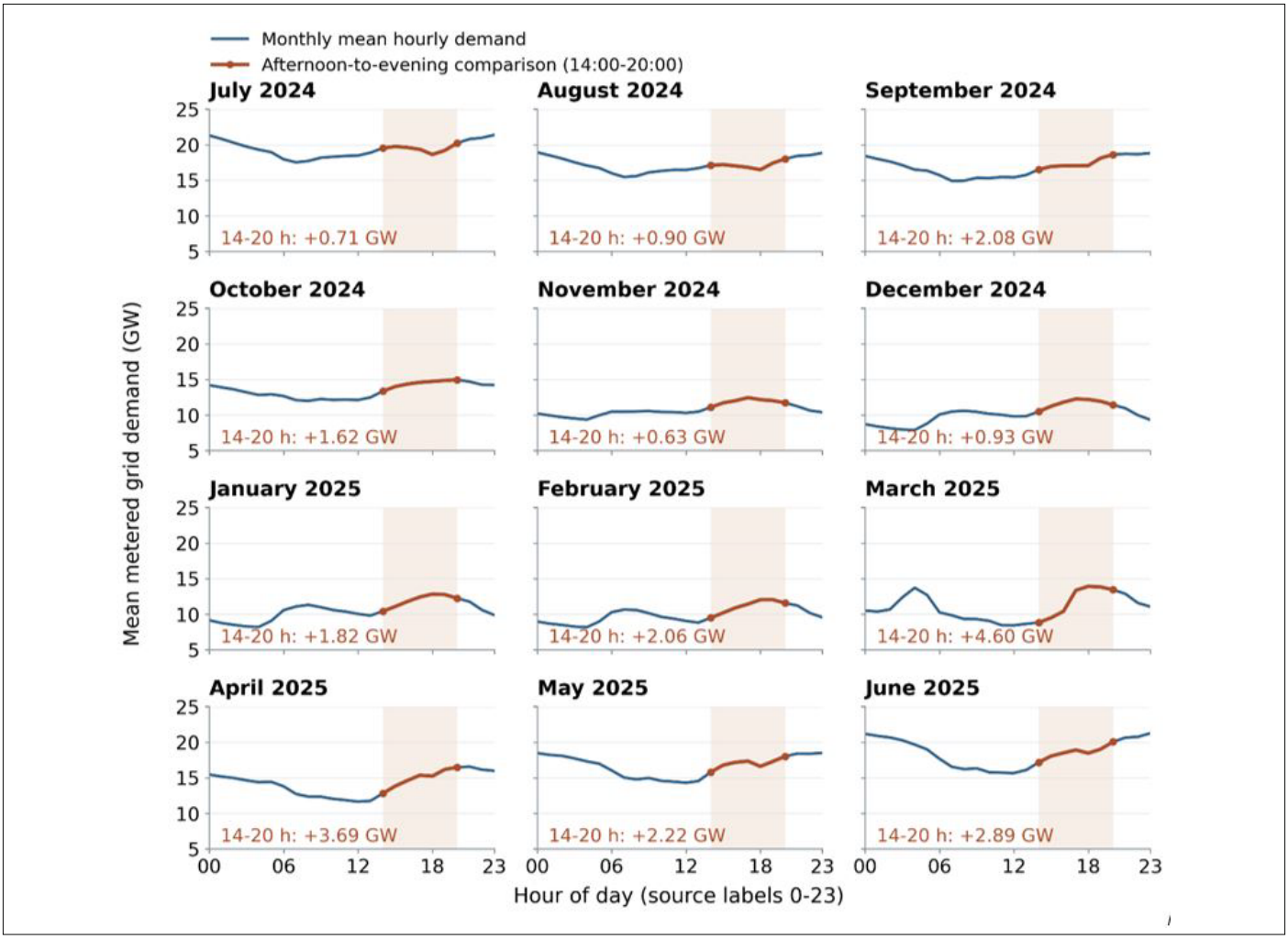
| Month | Recorded minimum, MW | Recorded maximum, MW | Mean increase, 14:00–20:00, MW | Largest one-hour increase within 12:00–22:00, MW/hour |
|---|---|---|---|---|
| July 2024 | 12,628 | 23,066 | 711 | 1,555 |
| August 2024 | 11,618 | 22,991 | 903 | 1,337 |
| September 2024 | 12,724 | 20,559 | 2,081 | 1,607 |
| October 2024 | 10,437 | 18,399 | 1,615 | 1,174 |
| November 2024 | 7,848 | 13,639 | 632 | 1,254 |
| December 2024 | 7,251 | 13,127 | 926 | 1,187 |
| January 2025 | 7,867 | 13,466 | 1,821 | 1,283 |
| February 2025 | 6,484 | 12,736 | 2,063 | 1,332 |
| March 2025 | 5,832 | 15,661 | 4,603 | 3,647 |
| April 2025 | 6,976 | 19,346 | 3,689 | 1,800 |
| May 2025 | 8,534 | 22,003 | 2,225 | 2,220 |
| June 2025 | 12,190 | 23,817 | 2,886 | 1,757 |

Source: Authors' calculations using metered hourly system-demand dataset of ISMO's for FY2025.

Note: Monthly minimum and maximum demands have been estimated from individual hourly observations. The mean afternoon-to-evening increase is the difference between monthly mean demand at 20:00 and 14:00, expressed in MW. The largest one-hour increase is calculated from actual consecutive hourly observations within 12:00–22:00, expressed in MW/hour. All the estimated values are rounded.

Figure 2 presents monthly mean hourly profiles. The mean increase from 14:00 to 20:00 hrs and reached approximately 4.60 GW in March, 3.69 GW in April and 2.89 GW in June. The largest observed one-hour increase within 12:00–22:00 was approximately 3.65 GW/hour in March. These observations provide a Pakistan-specific basis for assessing flexibility requirements.

## Figure 2: Monthly Mean Hourly Grid Demand and Afternoon-to-Evening Increases, FY2024–25, (Excluding K-Electric)




Source: Authors' calculations using ISMO's 8,760 metered hourly demand observations. Each profile averages the corresponding hour across all days within the month. Highlighted segments show the transition between 14:00 and 20:00 hrs.

Following solar PV rollout, there is evidently growing battery rush. This growing adoption of consumer-owned batteries may lower grid consumption even more unless users are incentivized to run these systems in ways that benefit the entire network (IEEFA, 2025; Renewables First, 2026; Rehman & Ali, 2026).

In view of above, the afternoon-to-evening transition becomes operationally important as solar power diminishes, other resources, now may including batteries, must sustain supply. These monthly profiles support assessing storage for scheduled charging, evening discharge and rapid response, alongside flexible generation and demand response. Weather, cooling demand and calendar effects also influence demand, and the contribution of behind-the-meter solar requires separate measurements. Additional flexibility requirements should, therefore, be established after accounting for existing resource capabilities and network constraints. The proposed assessment should determine the required power, duration, response time and location, and compare qualified resources on delivery, total cost and consumer benefit.

Pakistan should not respond by discouraging consumer-financed solar or dismissing new investment as unnecessary. Additional generation, transmission, distribution and storage will continue to be required as demand, electrification and climate risks evolve. New productive uses, such as industrial electrification, electric mobility, cold storage, and data centers can improve the utilization of existing capacity. However, their value will be determined in part by when and where electricity is used. The policy aim is, therefore, to build flexibility: the ability of the power system, producers and consumers to respond efficiently when supply, demand or network conditions change.

## 2. The Missing Value: Capacity is Paid, Flexibility is Not Fully Valued

Electricity consumers in Pakistan mostly pay for contracted generation capacity and the electricity delivered to the system. A reliable power system, however, requires more than just available megawatts. It must responds to rapid variations of demand, manage network congestion, and restore service following any disruption. Some of these functions are essentially required under the Grid Code or existing agreements, but their costs and contributions are not regularly monitored or transparently valued.

Consumers are already bearing the costs of limited dispatch and part-load operation. NEPRA's FY2024–25 Performance Evaluation Report records Rs 13.285 billion in Non-Project Missed Volume (NPMV) payments and Rs 44.6 billion in Part Load Adjustment Charges (PLAC) (NEPRA, 2026a). NPMV payments compensate for eligible missed generation under existing contracts and do not measure total renewable-energy curtailment while PLAC reflects fuel-cost adjustments from reduced thermal-plant efficiency at part load. These figures reflect the specific annual charges and do not constitute a complete assessment of flexibility-related costs or potential savings. The proposed assessment shall help to establish a comparable cost baseline across multiple fiscal years, distinguish physical curtailment from contractual compensation, and avoid double counting. Capacity payments compensate contracted availability and adequacy but do not necessarily reward rapid response, sustained delivery or locational value.

This fragmented framework places potential flexibility providers on unequal footing. A hydropower plant, a flexible thermal unit, a battery storage facility, an industrial consumer, and aggregated distributed resources can all support grid stability, yet each operates under a different regulatory and contractual obligation. This undermines the required competitiveness and lower to no incentives for reliable performance. It also obscures three critical distinctions: contracted capacity may not be operationally available due to fuel shortages, outages, or slow start-up times; available electricity generation may not reach a specific location due to network constraints; and an available flexible capacity has little value unless it can be activated, measured, and verified. The contemporary literature consistently emphasizes that flexibility markets work only when products, baselines, prequalification, activation, settlement and coordination between operators are designed as one system (Mentens et al., 2025; Cano-Martínez et al., 2025; Michaelis et al., 2025).

A flexibility mechanism, in this Policy Viewpoint, refers to arrangements through which the system operator or distribution company identifies a specific requirement, procure eligible resources, activate services when required, verify delivery, and make performance-based payments. It does not necessitate a new power exchange and is distinct from a capacity market, which focuses on ensuring sufficient future capacity. A flexibility mechanism determines whether resources can respond at the requisite pace, for the necessary duration, and provide support at the location where it is required.

The mechanism should be technologically neutral, but it should not adopt the same procurement approach for all services. Competitive procurement could potentially be appropriate in cases where requirements are clearly defined and multiple providers can participate. Regulated obligations or bilateral agreements may be preferable for critical system security services or locations with only one capable provider. Table 2 matches Pakistan's core flexibility requirements, as well as appropriate initial approaches and implementation scenarios. The detailed design should be directed by system requirements and NEPRA-approved rules rather than a preference for a particular technology (NEPRA, 2023).

**Table 2: Matching Flexibility Needs with Suitable Procurement Approaches**

| System needs | Problem it addresses | Initial approach | Conditions for implementation |
|---|---|---|---|
| **Fast balancing and operating reserves** | Unexpected changes in electricity supply or demand can disturb system frequency and reliability. | Begin with a small, capped competitive pilot involving technically qualified providers. | Quantify the requirement; define response time and duration; ensure sufficient providers; measure and verify delivery. |
| **Midday surplus and minimum-load management** | Solar-rich hours can sharply reduce grid demand, forcing some plants to operate inefficiently at low output or requiring available electricity to be curtailed. | Use a capped pilot for resources that can absorb electricity or reduce output when instructed. Regulated re-dispatch may continue where competition is not yet practical. | Identify the season, hours and locations of need; establish baselines and metering; map existing contracts; prevent duplicate compensation. |
| **Evening ramp and multi-hour peak support** | Demand from the grid increases rapidly as solar output falls, requiring additional supply or reduced consumption for several hours. | Introduce competitive procurement after testing the ability of participating resources to respond and sustain delivery. | Test ramping speed and duration; confirm fuel or stored-energy availability; establish measurement and settlement rules. |
| **Local network congestion and voltage support** | Electricity may be available nationally but cannot always be delivered to a particular area because of transmission or distribution constraints. | Use targeted procurement by the relevant network company, bilateral arrangements or regulated network investment, depending on the number of available providers. | Conduct location-specific studies; compare network and non-network solutions; define responsibility for activation, measurement and payment. |
| **Essential system-security services** | The system requires stability during disturbances and the ability to restart after a major outage. As distributed solar displaces synchronous plants at midday, minimum system inertia and short-circuit strength become binding constraints. | Begin with mandatory technical obligations or bilateral procurement. Competitive procurement should be considered only where the service can be clearly measured and several providers exist. | Establish technical standards, testing procedures and clear accountability; verify that the service is not already compensated under an existing contract. Monitor minimum inertia and recheck underfrequency load-shedding settings against low-inertia conditions. |

Source: Authors' expert assessment. Final procurement arrangements should be based on the proposed flexibility-needs study and NEPRA-approved rules.

The procurement approaches in Table 2 must account for existing contracts. CPPA-G should identify services that are already covered by legacy power-purchase agreements, to avoid duplicate payments, and ISMO should provide the necessary assistance. Existing generators should receive additional payment only for verified services beyond those already required or compensated. New providers, such as storage facilities, aggregators, and responsive customers, should adhere to the same service-specific requirements. Linking payment to verifiable delivery will promote productive investment, increase participation, and protect consumers from duplicative expenses.

## 3. Existing Foundations and the Remaining Market Gap

Pakistan does not need to build a flexibility framework from scratch. The Grid Code 2023 already recognizes operating reserves, frequency and voltage support, synthetic inertia, demand response, energy storage response, and system restoration services, including the technical roles that generators, storage facilities, aggregators, and bulk consumers can perform in supporting system operations. The Market Commercial Code 2025 further provides arrangements for balancing, ancillary-service scheduling, compensation and settlement (NEPRA, 2025). ISMO is responsible for real-time balancing, transmission scheduling, and reserve management, while CPPA-G continues to oversee legacy power-purchase contracts as Special Purpose Agent (NEPRA, 2023; ISMO, n.d.; CPPA-G, n.d.)

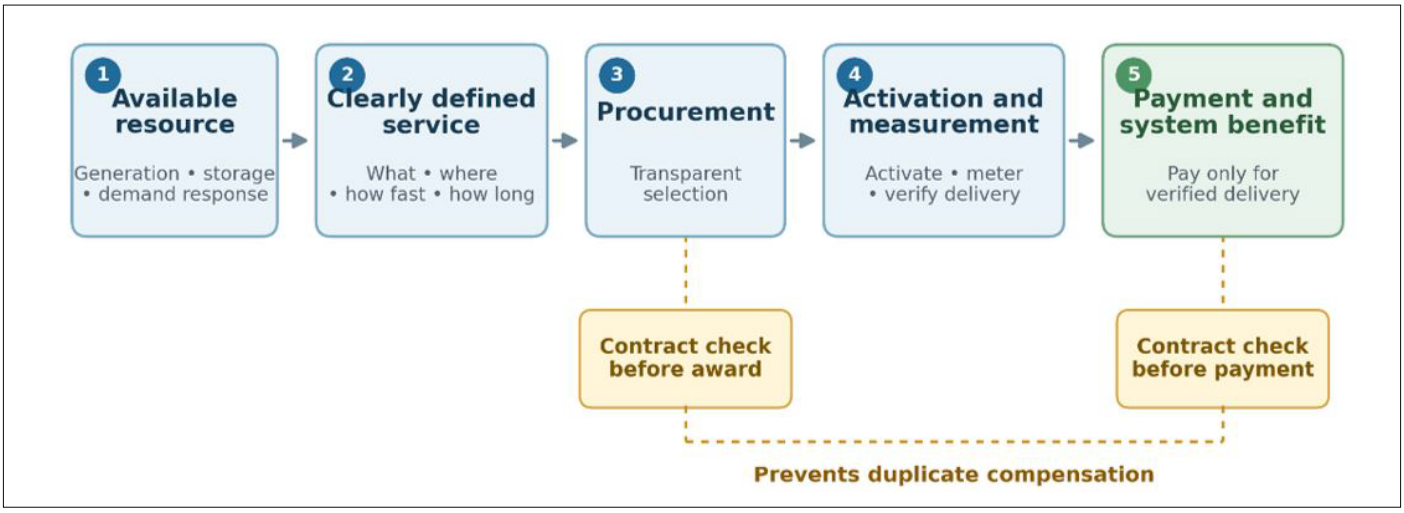
The Competitive Trading Bilateral Contract Market (CTBCM) also establishes a framework through which qualifying buyers and sellers can enter bilateral electricity contracts across the national grid (NEPRA, 2020).

NEPRA's decision on PESCO's investment plan for the distribution system also emphasis advanced metering infrastructure, SCADA, and related digital investments (NEPRA, 2026b). Proposed battery-storage components for wheeling arrangements as well as the Asian Development Bank's planned grid-integrated storage project, could give valuable operational expertise (Kiani, 2026; ADB, 2026).

These developments provide institutional and regulatory basis for Pakistan's transition towards enhanced power system flexibility. This viewpoint, as such, builds on Grid Code, Market Commercial Code, and CTBCM framework by proposing a flexibility operationalizing framework to make most of the available resources. It, therefore, proposes a limited, technology neutral pilot with clearly defined services, participation requirements, and essential safeguards for the consumer. Mandatory technical obligations, and services already compensated through existing contracts should be differentiated from additional services eligible for payment (NEPRA, 2023; NEPRA, 2025).

The proposed flexibility need assessment should update and complement existing operating reserve studies and IGCEP reserve and storage analyses (ISMO, 2025b). It is anticipated that this process shall translate the findings and update operational evidence into requirement by service, season, time and location thus providing a basis for comparing qualified flexibility resources . As illustrated in Figure 3, proposed sequence connects resource capability with verified system value. The pilot shall subsequently help to test this sequence under Pakistan's operational and contractual condition by assessing actual delivery, total costs, reliability, and consumer benefits.

**Figure 3: From Resource Capability to Verified System Value**

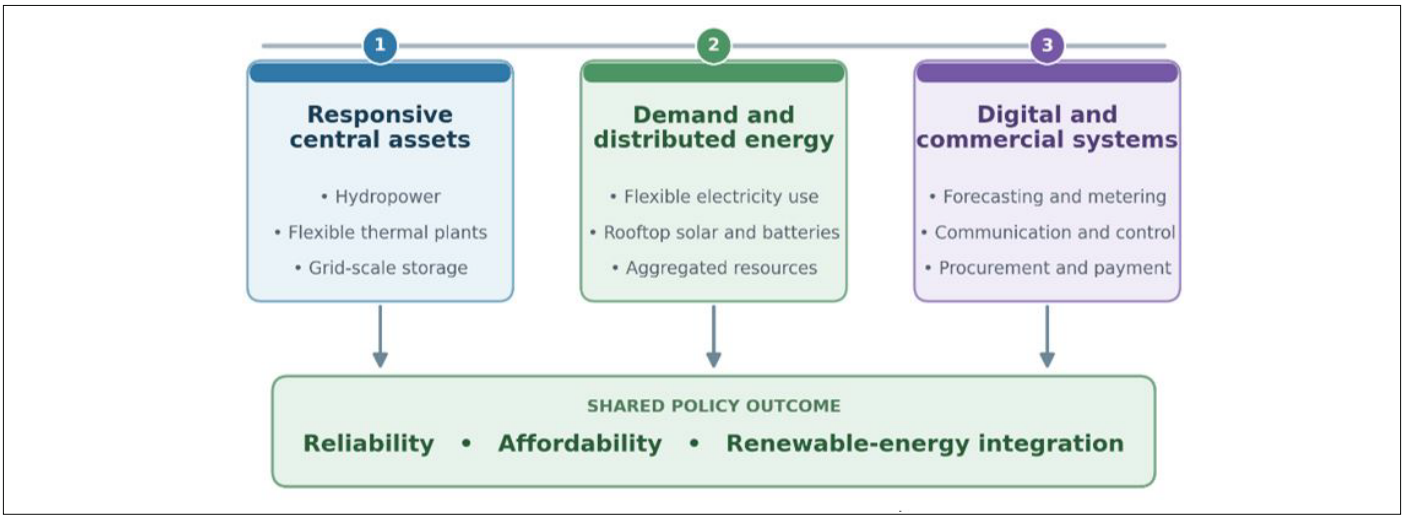



Source: Authors' illustration.

## 4. Three Building Blocks for Pakistan's Flexibility Framework

A power systems flexibility framework may be built on three mutually reinforcing building blocks: responsive central assets; active engagement by consumers and distributed energy resources; and the digital and commercial platforms required to coordinate, measure, and reward performance. Progress is required in all three areas since equipment alone cannot provide flexibility without appropriate information, incentives, and operational procedures.

**Figure 4: Three Building Blocks for Pakistan's Flexibility Framework**




Source: Authors' illustration.

## 4.1 Building Block 1 – Make Existing Central Assets More Responsive

Assets currently connected to the national grid may be the quickest and most cost-effective source of flexibility. Reservoir hydropower can vary output, while designated thermal power plants can operate at lower levels or respond more rapidly, and grid-scale storage can absorb, or supply electricity as required. The recommended flexibility-needs assessment should examine assets' actual capabilities rather than just relying on the installed capacity. It is required to identify an affordable retrofit, improved control system, or revised operating methods which can generate measurable value, performance-based rewards may be used to support the necessary upgrades. International experiences suggest that existing conventional plants can become more responsive through improved operating procedures, technological upgrades, and appropriate incentives (IRENA, 2019).

## 4.2 Building Block 2 – Turn Demand and Distributed Energy into Responsive Resources

Following essential assessment, and compliance of standards; consumers should be able to contribute to the electricity grid. Industrial facilities can reschedule certain activities, commercial buildings can adjust cooling demand, and electric car charging can be switched to solar-rich hours. Aggregators could combine various solar systems, smaller batteries, or controlled devices to provide a single resource with the combined capability. This would enable distributed resources to participate without the system operator having to handle millions of individual devices. Such participation could help to minimize peak demand, improve the use of existing assets, and promote renewable energy integration (IEA, 2025). Under the provisions of contemporary prosumer agreements, net billing mechanisms provide enhanced incentives for self-consumption relative to electricity exports, thereby promoting the adoption of battery storage systems or adaptable load management to utilize daytime solar generation (NEPRA, 2026c). However, it does not compensate for resources for controllability or verified grid services. Aggregation, therefore, should be based on verified availability, and performance, rather than exported electricity alone. Valid agreements executed under the previous regulation should remain protected until their expiry. It will, however, require specific guidelines for consumer consent, data protection, measurement, cybersecurity, and participation withdrawal. One step precedes all of these. Registered prosumer systems are subject to licensee approval and inverter and protection requirements , but wider behind-the-meter systems may remain unregistered. Registration alone also does not provide ISMO with real-time visibility or control. Aggregation should, therefore, require a resource registry, proportionate telemetry and control, appropriate ride-through standards and performance testing.

## 4.3 Building Block 3 – Build the Digital and Commercial Operating Layer

Flexibility cannot be accurately measured or rewarded using traditional monthly meter readings. ISMO and participating DISCOs will require timely information on electricity consumption, network conditions, renewable energy forecasts, and resource performance. A verified registration of qualified resources should establish what each participant has to offer, whereas transparent system should document when support was requested, provided, and paid for. Implementation should start in places where adequate metering, connectivity, and operating capacity are already available. Expansion should proceed only if tested pilots

demonstrate considerable benefits. The digital investment should be measured by envisaged benefits and should include and not limited to improved reliability, lower balancing costs, lower peak load, and deferred network investments instead of counting the number of meters, devices, or software platforms installed.

## 5. Potential of Available Flexibility Resources

Pakistan can draw flexibility from a diverse portfolio of existing and emerging resources suited to different services, delivery durations and locations. Qualified thermal and reservoir, hydropower plants can provide required flexibility and follow demand changes, while batteries can deliver rapid response and shift energy from solar-rich hours to evening ramp. Industrial and commercial loads and managed electric-vehicle charging can shift consumption, while aggregators can coordinate DER including storage and controllable loads. Local voltage and congestion constraints may require smart inverters, grid-support equipment or targeted network measures. Resource selection should reflect assessed needs, operational availability and total system cost, supported by appropriate metering, consumer safeguards and contractual arrangements.

Table 3 assesses the key resources' potential contributions for the fast response, evening support, and local grid support. These ratings are only indicative suggestions and do not reflect final procurement choices. Actual eligibility should be established by system study, technical testing, and performance validation. A portfolio of qualified resources will increase competitiveness, make better use of existing assets, and reduce dependency on a single technology, fuel source, or supplier (NEPRA, 2023; IRENA, 2019; IEA, 2025; ADB, 2026).

**Table 3: Potential of Available Flexibility Resources**

| Resource | Quick response | Evening support | Local grid support | What is needed |
|---|---|---|---|---|
| **Reservoir hydropower** | Strong | Strong | Moderate | Clear water-use rules and verified ability to increase or decrease output when required. |
| **Flexible thermal plants** | Moderate | Strong | Moderate | Reliable fuel supply and testing of minimum output, start-up time and ability to change output. Existing contracts must be checked before additional payment. |
| **Grid-scale battery storage** | Strong | Strong | Strong | Clear storage rules, suitable metering and control systems, and arrangements prevent overlapping payments for the same service. |
| **Industrial and commercial demand** | Moderate | Strong | Depending on location | Reliable consumption baselines, suitable notice periods, measurement arrangements and safeguards against disruption to essential production. |
| **Aggregated batteries and controllable demand** | Strong | Moderate | Strong | Rules for aggregators, compatible digital systems, reliable communications, consumer consent and protection of customer data. |
| **Managed EV charging** | Moderate | Strong | Moderate | Smart chargers, time-based price or control signals, suitable metering and the right of consumers to opt out. |
| **Grid-support equipment** | Limited | Limited | Strong | Local network studies, clear technical standards and procurement by the relevant transmission or distribution company. |

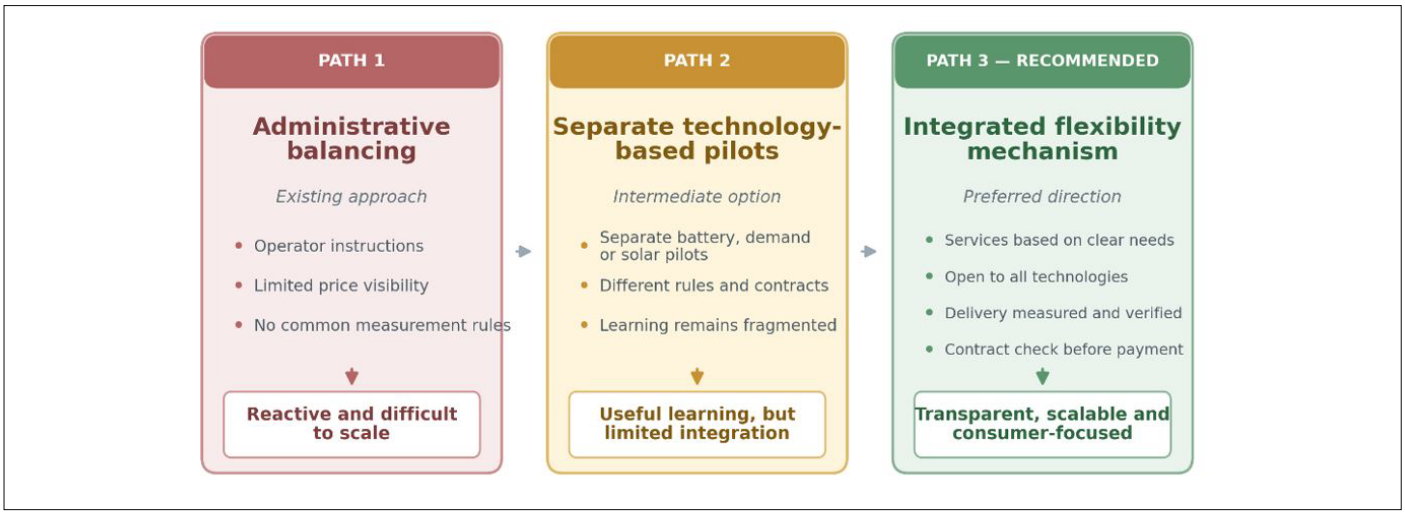
Source: Authors' expert assessment based on NEPRA (2023), IEA (2025), IRENA (2019), IEEFA (2025) and ADB (2026). The ratings are indicative and should be confirmed through detailed system studies.

## 6. A Phased Transition and 36-Month Roadmap

This policy viewpoint suggests three distinct pathways for achieving Pakistan's transition to power system flexibility. It may essentially continue to rely on administrative balances and existing contractual obligations. This approach is institutionally familiar; however, it provides limited information regarding the cost and effectiveness of individual services, and very few opportunities for new entrants. Another approach could be to implement separate technology-based pilot programs for batteries, smart meters, and aggregated consumer resources. The proposed pilots can provide valuable insight. However, defining rules and data systems in isolation may remain disconnected and difficult to scale. The preferable option is, therefore, an integrated flexibility mechanism that matches clearly stated system requirements with qualified resources based on standard performance, measurement, and payment principles.

An integrated mechanism does not require that all services be competitively procured immediately. Pakistan's strategy should be based on existing institutions, contractual obligations, and operating conditions. Competition should be employed when requirements can be measured and several providers can participate; controlled or bilateral arrangements may be appropriate elsewhere. The shift should, therefore, proceed in stages, with strict regulatory control, restricted consumer exposure, and clear testing before each stage progresses (Sirin, Abuouf, & Elshurafa, 2025).

**Figure 5: Three Pathways for Pakistan's Flexibility Transition**




Source: Authors' illustration.

During the first twelve months, ISMO should lead a national flexibility-need assessment with assistance from NGC, DISCOs, and CPPA-G, under NEPRA's supervision. The assessment should use at least one complete fiscal year of hourly demand and generation data, present monthly profiles, and calculate actual upward and downward ramps. Supplementary sub-hourly dispatch and reserve records, high-resolution frequency data and network studies should establish requirements by service, month, time and location, including power, duration and response specifications. Existing and emerging resource capabilities, and services already compensated through contracts or tariffs, should be assessed before additional requirements are quantified. Findings should complement operating-reserve studies, IGCEP and TSEP analyses, with non-confidential results published.

Between months twelve and eighteen, NEPRA should approve a restricted pilot program with two or three clearly defined and specific locations. Possible services include rapid response to sudden system disruption, support during an evening ramp in grid demand, and temporary adjustments to consumption by large consumers. Participation should be open to all resources that meet the same performance requirements. The pilot program should set eligibility criteria, metering requirements, consumer baselines, payment methods, expenditure limits, and penalties for non-delivery. NEPRA should also approve an explicit cost envelope before bidding opens, stating the volume sought for each service, the annual procurement cost, the saving expected to offset it, and the tariff route through which the cost will be recovered. A documented review of existing contractual obligation and compensation, before any award, must be undertaken to avert duplicate payments for validated services.

Every activation should be appropriately recorded and quantified during months eighteen and thirty. The findings should include the magnitude and quality of supplied flexibility, procurement and integration costs, avoided balancing activities, reliability rewards, and competitiveness level. The assessment, therefore, should determine whether the benefits outweigh the cost of procurement, metering, communications, and administration.

From month thirty to thirty-six, NEPRA and the Power Division should decide whether the mechanism should be scaled. Proven arrangements may require changes to existing legislation, licensing, metering restrictions, and market procedures. These adjustments should clarify the function of storage and aggregators, protect consumer data, and allow for transparent measurement, payment, and dispute resolution methods. Flexibility should then be included in generation, transmission, and distribution planning only when it provides a more reliable and cost-effective alternative to conventional investment. Table 4 summarizes the timeframe, institutional duties, and decision tests for each stage.

**Table 4: Proposed 36-Month Roadmap**

| Period | Priority actions | Lead and supporting institutions | Decision test |
|---|---|---|---|
| **1–12 months: Establish the evidence base** | Complete a national flexibility-needs study covering service, month, time and location, using full fiscal-year hourly data and supplementary operational and network records. | **ISMO leads.** NGC, DISCOs, K-Electric and CPPA-G provide operational support and contractual information; NEPRA oversees the regulatory process. | Proceed only if priority needs have been quantified, capable resources identified and existing contractual payments mapped. |
| **12–18 months: Design and approve a limited pilot** | Select a small number of services and locations. Establish eligibility requirements, participation rules, consumption baselines, measurement procedures, payment arrangements, spending limits and consumer protections. Require an existing contract review before any resource is selection to avoid duplicate compensation. | **NEPRA approves the pilot framework. ISMO designs and administers it. NEPRA appoints an independent market monitor, separate from ISMO, with full access to procurement, activation and settlement data.** CPPA-G supports legacy-contract and payment interfaces; PITC, DISCOs, K-Electric and NGC support data and operational arrangements. | Proceed only if different capable technologies can participate fairly, delivery can be measured and duplicate compensation can be prevented. |
| **18–30 months: Operate, monitor and evaluate** | Operate the capped pilot. Record every activation and measure actual delivery. Publish aggregated monthly results covering performance, procurement cost and system benefits. Commission an independent evaluation. | **ISMO leads implementation and verification.** Relevant network companies support activation and measurement; CPPA-G supports legacy payment interfaces where applicable; an independent evaluator assesses results. | Continuing only if verified reliability and consumer benefits exceed procurement, metering, integration and administrative costs. Otherwise, redesign or discontinue the pilot. |
| **30–36 months: Decide whether to scale** | Publish the final evaluation. Scale successful services, redesign weak elements or discontinue unsuccessful products. Amend relevant codes, licenses and market procedures. Integrate proven flexibility into national generation, transmission and distribution planning. | **NEPRA and the Power Division lead the policy decision.** ISMO, NGC, DISCOs, K-Electric and CPPA-G implement approved changes within their respective responsibilities. | Scale only where the mechanism reduces total system cost, improves reliability, prevents duplicate payment and can be replicated using reliable data and clear accountability. |

Source: Authors' proposed implementation roadmap.

## 7. Conclusion

Pakistan's apparent surplus of installed capacity should not be confused with an electricity system capable of reliably delivering dependable and economical power at the appropriate time and location. The immediate policy requirement is to make current and future resources more responsive, measurable, and useful. With surplus megawatt, network constraints, increased rooftop solar and energy storage technologies, a developing phased flexibility and ancillary-services mechanism is need of the hour. It can provide a practical path forward by commencing a national assessment of system needs, testing a small number of services in a limited and technology-neutral pilot, and expanding only when proven consumer and system benefits outweigh the costs. Existing power plants, storage, responsive consumers, and aggregated distributed resources should compete to fulfill common performance goals, while contractual review should prevent duplicate payment for services already compensated . The key focus of these reforms should not be adding another commitment to procure equipment or adding megawatts, but rather a disciplined process to identify system demands at different time intervals and delivering to the system through flexibility, paying only for verified delivery, and directing investment toward capabilities that improve reliability, affordability, and renewable-energy integration.

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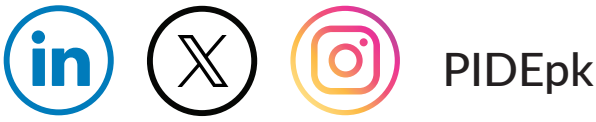

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