Consequences of the Protected Tariff Threshold on Residential Electricity Subsidy Targeting in Pakistan

Atif Sardar Khan[1,*], Sadaf Sardar Khan[2], Arbab Masood Ahmad[3]
[1]U.S. Pakistan Center for Advanced Studies in Energy, University of Engineering and Technology Peshawar, Peshawar 25000, Pakistan
[2]Department of Mechatronics Engineering, University of Engineering and Technology Peshawar, Peshawar 25000, Pakistan
[3]Department of Computer Systems Engineering, University of Engineering and Technology Peshawar, Peshawar 25000, Pakistan
*** Correspondence:** atifsardarkhan@uetpeshawar.edu.pk

Citation | Khan. A.S , Khan. S.S , Ahmad. A. M , "Consequences of the Protected Tariff Threshold on Residential Electricity Subsidy Targeting in Pakistan",IJIST, Vol. 8 Issue.11 pp 4235-4261, November 2026
Received | Oct 05, 2026 **Revised |** Oct 25, 2026 **Accepted |** Oct 11, 2026 **Published |** Nov 18, 2026.

A protected category of residential electricity consumers was introduced in Pakistan in September 2021 for households consuming 200 kWh or less in each of the previous 6 months, with the aim of directing the tariff subsidy to the poorest 40% of households. In this study, the category is evaluated against its design target using 5 tariff decisions issued between 2021 and 2026, the periodic adjustment decisions and the performance report of the distribution companies. Household consumption is not measured: the consumer counts and sales by tariff block are reported in the decisions, and all other values are derived from them. As reported, the rule is designed to protect 44.4% of residential consumers, whereas the protected share is 27.8%, 54.0%, 56.4% and 58.8% in 2022, 2024, 2025 and 2026, respectively. As derived, the monthly bill gap at 190 kWh, including sales tax, rises from zero to Rs 3,093, a cost of Rs 18,557 over the 6 months that follow a single month above 200 kWh. The derived share of residential sales above 200 kWh falls from 46.0% to 39.1% between 2024 and 2026, with the largest fall in the companies where protection grows fastest (Spearman −0.87, 95% confidence interval −0.98 to −0.43, p = 0.001, 10 companies). The association is partly mechanical but persists after controlling for losses, load shedding and net metered solar export. For target shares of 40% and 44.4% of meters, the estimated lower bounds show that at least 30.5% and 37.4% of the target group, respectively, is excluded in 2022, whereas at least 32.0% and 24.5% of protected meters, respectively, lie outside it in 2026. The associations of protection with losses and load shedding are not significant after false discovery rate control. The protected subsidy of Rs 474 billion per year equals approximately two thirds of the national cash transfer budget.

Keywords: electricity subsidy; protected consumers; increasing block tariff; subsidy targeting; Pakistan

Introduction:

Typically, electricity subsidies in developing countries are delivered through low tariff blocks, which require no household information beyond metered consumption. However, consumption is an imperfect proxy for income, and block tariffs deliver a considerable share of the benefit to households that are not poor [1][2][3]. In Pakistan, the tariff differential subsidy for residential consumers has been estimated at more than 2% of gross domestic product in some years, and earlier studies have found it poorly targeted [1][4][5]

In 2021, a structural change was introduced by the Government of Pakistan to address the targeting problem. A protected category was created for consumers whose monthly consumption remained at or below 200 kWh in each of the previous 6 months, a rule selected as the closest to the 11 million households in the bottom 40% [6]. From 2022 onward, protected consumers are shielded from most base tariff increases, whereas non protected consumers bear them. In 2026, the Government assured the International Monetary Fund that the protected subsidy is to be replaced from January 2027 with a targeted subsidy delivered through the Benazir Income Support Program and linked to the National Socio Economic Registry [7]

Earlier studies examine the targeting of residential electricity subsidies in Pakistan. [1] developed a benefit incidence analysis of the 2008 and 2011 tariff structures and showed that the richest households remained the greatest beneficiaries. [4]combined survey, billing and registry data and showed that targeting improves considerably with proxy means test scores. In[5], a computable general equilibrium model showed that the greater share of the subsidy reached relatively non poor households. Similarly, [8]and [9]estimated the welfare effects of price reform, and [10]identified regulatory, political and financial barriers to social welfare measures in the tariff.

Recent studies from Pakistan confirm the targeting problem and add the affordability and supply dimensions. [11]also performed a benefit incidence analysis of the 2012 and 2015 tariffs and reported a significant leakage of the subsidy to the richest households after the 2013 reform. Similarly, [12]modeled the tariff differential subsidy with a computable general equilibrium model and found it to be an untargeted subsidy that benefits mainly the urban rich and adds to the circular debt. Moreover, [13]analyzed 8 rounds of the Household Integrated Economic Survey and observed that energy poverty in Pakistan rose between 1998 and 2019, whereas [14]estimated a relatively high own price elasticity of residential electricity demand, with low-income groups more price elastic than high income groups.

Furthermore, the grid demand of households is altered by rooftop solar generation and by load shedding. [15]reported short payback periods for urban residential photovoltaic systems even without net metering, [16]described the shift of affluent households away from grid supply, and [17]associated the tariff increases under the program of the International Monetary Fund with a rise in distributive energy injustice. [18]measured the household response to outages in Lahore and observed rebound peaks after load shedding.

The experience of other developing countries points in the same direction. [19]showed for Vietnam that the below cost first blocks of the block tariff are ineffective in supporting the poor, and [20]found for Brunei Darussalam that the poorest 20% received 18% of the subsidy after the move to block tariffs, against 11% before. Moreover, [21]measured subsidies of 50% to 80% of the final price in Argentina and showed that the net benefit falls below half of the gross subsidy once the financing is taken into account. Similarly, [22]observed that households above a new block threshold in Kyrgyzstan switched to coal, wood and dung, and [23]estimated that approximately 608 million people in Sub Saharan Africa cannot afford grid electricity at the present tariffs.

The response of households to a consumption threshold is reported in several studies. [24] showed that households respond to the average and not to the marginal electricity price,

[25]reviewed the bunching methods for thresholds and notches. [26]observed a distinct bunching of consumption below the 50 kWh free electricity threshold of Thailand, and [27]found that households eligible for the social tariff of Brazil consume approximately 20 kWh per month less than households just above the income cutoff. [28]reported reductions of approximately 43 kWh and 120 kWh for households in the second and third blocks of the Chinese block tariff, whereas [29]showed with more than 40 million bills from Ethiopia that the apparent bunching at block kinks disappears once the billing cycle length is normalized. Moreover, leakage and multiple connections are reported for block tariffs in Sub Saharan Africa [2]and Addis Ababa [3], and the subsidies tied to small connection capacities in Indonesia continue to favor affluent households [30][31]

The Free Basic Electricity allowance of South Africa [32][33], the cash transfer of Iran [34], the 12-month high-consumption tariff of Mexico, from which grid-connected photovoltaic systems return households to the subsidy [35], and the reduction of consumption by outages in [36], complete the reported international experience.

Several studies on electricity subsidies in Pakistan are reported in the literature, but the reported studies analyze the earlier slab structure [1][4][5][11], model the welfare effects of reform scenarios[8][9][12] or examine the institutional barriers to reform [10]The international studies of threshold response examine a threshold applied to the consumption of a single billing period[24][26][28][29], whereas the Pakistani rule makes eligibility depend on the household's own history of 6 monthly readings. Moreover, the protected category has a published design target, and no evaluation of the category against that target is available in the literature.

The objectives of this study are as follows.

(1) To measure the coverage of the protected category as the protected share of residential consumers and of residential sales from 2022 to 2026, and to compare it with the design coverage of 44.4%, using the consumer counts and sales by slab published in the tariff decisions.

(2) To quantify the price incentive to remain protected as the monthly bill gap and the 6 month cost at 190 kWh, including fixed charges, periodic adjustments and sales tax, and to measure the response to the 200 kWh threshold. As household consumption is not published, the response is measured as the change in the share of residential sales above 200 kWh by company between 2024 and 2026 and its rank correlation with the growth of protection.

(3) To derive lower bounds on the exclusion and inclusion errors from the protected share and the target share of 40%, with their sensitivity to the target share.

(4) To test the association of protection across 9 distribution companies with losses, recovery, load shedding and net metered solar export, reported with 95% confidence intervals and false discovery rate control.

(5) To compute the fiscal cost of the category per year and per protected consumer and to compare it with the national cash transfer program.

Novelty Statement:

To the best of the authors' knowledge, this study provides the first evaluation of the protected residential electricity category of Pakistan against its own design target, based entirely on official regulatory documents from 2021 to 2026. The reported benefit incidence studies of Pakistan and other developing countries rely on household survey microdata [11][19][20][21] which are not available for the years in which the rule operates, whereas the present method follows the rule over 5 years from the administrative tables alone. Moreover, a block based method is introduced to recover the mean consumption of protected consumers and the shift of residential consumption across the threshold without household data. The new findings are the reversal of the targeting error from exclusion in 2022 to inclusion from 2024 onward, the size of the notch created by the 6 month rule once all bill components are

included, and the concentration of the shift below the threshold in the companies where protection grows fastest, which persists after controlling for losses, load shedding and net metered solar export.

Materials and Methods:

Study Area:

The study covers the service areas of the 11 state-owned distribution companies of Pakistan, which supply all provinces except the Karachi region, which is served by K-Electric. The service area of each company is depicted in Figure 1, together with the protected share of residential sales of each company in 2026. The boundaries are obtained by aggregating the district boundaries of the geoBoundaries database[37] according to the districts served by each company. The Hazara company is separated from the Peshawar company in 2025, so the Peshawar figures for 2024 include the Hazara districts. The Tribal Areas company serves the merged tribal districts of Khyber Pakhtunkhwa, whereas Gilgit Baltistan and Azad Jammu and Kashmir are supplied by their own power departments and are not part of the residential sales of the companies.

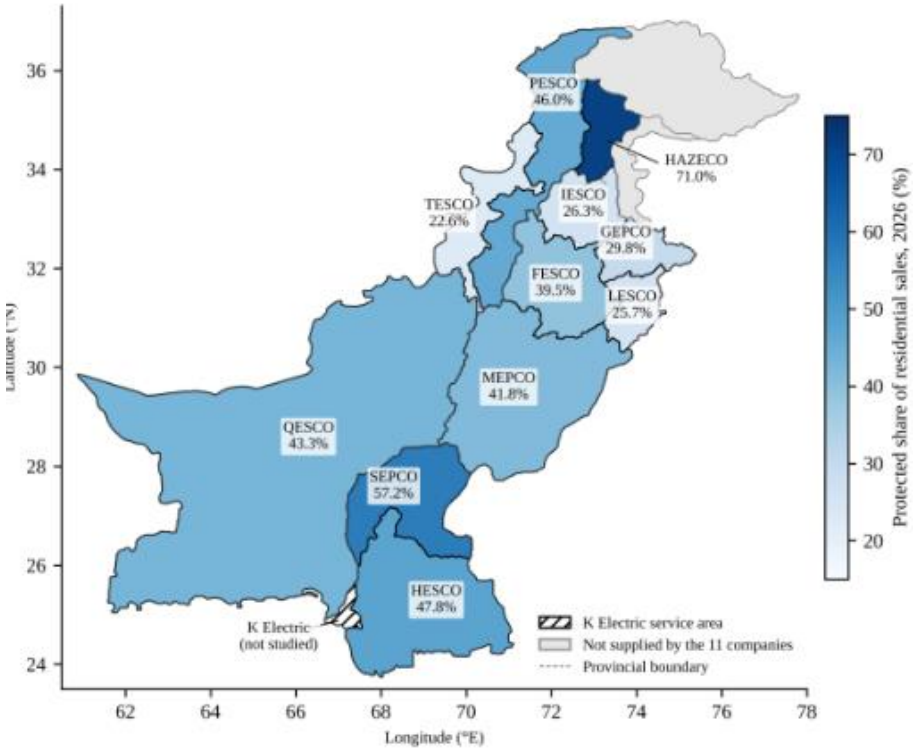

Figure 1. Distribution company service areas [37][38]

Karachi is excluded as K Electric is a privately owned, vertically integrated utility with a separate tariff determination, and the company level annexes of consumers and sales by protected slab used in this study are published for the state-owned companies only [38] [39][40] The uniform residential tariff, including the protected slabs, applies to K Electric consumers as well, so the exclusion limits the geographic coverage of the evaluation and not the policy that is evaluated. The possible impact of the exclusion on the national results is bounded as follows:

$$s' = \frac{C + p_K N_K}{R + N_K} \times 100 \quad (1)$$

where s' is the national protected share with Karachi included (%), C and R are the protected and total residential consumers of the 11 companies, N_K is the number of K Electric residential

consumers and p_K is their unknown protected share. K Electric reports more than 3.8 million customers of all categories in 2025 [41]so N_K is taken as 3.8 million, an upper bound for the residential consumers, and p_K is varied between 0 and 1. Moreover, the threshold value of $N_K$at which the national share would fall to the design coverage of 44.4% is obtained for p_K = 0.

Data Collection:

The design figures are obtained from the NEPRA determination of 23 September 2021 [6], the consumers and sales by category from the decisions of 11 July 2024, 1 July 2025 and 11 February 2026[38][39],[40] and the company losses, recovery and load shedding from the performance evaluation report for 2024 to 2025 [42]. Moreover, the rates of July 2023 are obtained from the decision of 25 July 2023[43], the net metered export from the quarterly adjustment decision of 9 May 2025[44] the treatment of protected consumers in the periodic adjustments from the adjustment decisions of 2025 [45][46][47], and the district boundaries from the geoBoundaries database[37].

Each tariff decision contains an annex of estimated sales by consumer category for every distribution company, in which the residential sales are reported separately for the lifeline, protected and non protected slabs. The sales in the annexes are the annual sales projected by the companies for the tariff year from their recorded sales, and the consumer counts are the counts reported with them. The values are administrative estimates of billed consumption and not measurements of household consumption. The protected share of residential sales is computed for each company as follows:

$$s_{d,t} = \frac{E^P_{d,t}}{E^R_{d,t}} \times 100 \qquad (2)$$

where $s_{d,t}$ is the protected share of residential sales of company d in year t (%), $E^P_{d,t}$ is the sales to protected consumers in the 1 to 100 kWh and 101 to 200 kWh slabs (GWh), and $E^R_{d,t}$ is the total residential sales (GWh). Each scanned annex is checked against its printed total, with agreement within 0.3%. Moreover, the national protected sales obtained from the sum of the company annexes are 14,412 GWh, 15,856 GWh and 18,904 GWh for 2024, 2025 and 2026, respectively, against 14,413 GWh, 15,857 GWh and 18,905 GWh in the national tables of the same decisions [38][39][40].

Research Methodology:

The methodology is depicted in Figure 2. As shown in Figure 2, the work proceeds in 5 stages. In the data collection stage, the design target is taken from the 2021 determination, the consumers, sales by tariff block and rates from the tariff decisions, and the company characteristics from the performance report and the quarterly decision of 2025. In the validation stage, the company annexes are checked against the printed totals and the national tables, the change of coverage in the consumer totals is identified, and the missing years and companies are recorded. In the calculation stage, each quantity is computed for one objective: the protected share for objective 1, the bill gap and the share of sales above 200 kWh for objective 2, the error bounds for objective 3, the net metering intensity and sales per consumer for objective 4, and the subsidy per consumer for objective 5. In the statistical stage, the rank correlations are reported with confidence intervals and false discovery rate control, and the sensitivity of the results to coverage, Karachi and the target share is evaluated. Finally, the results are evaluated against the 2021 design target.

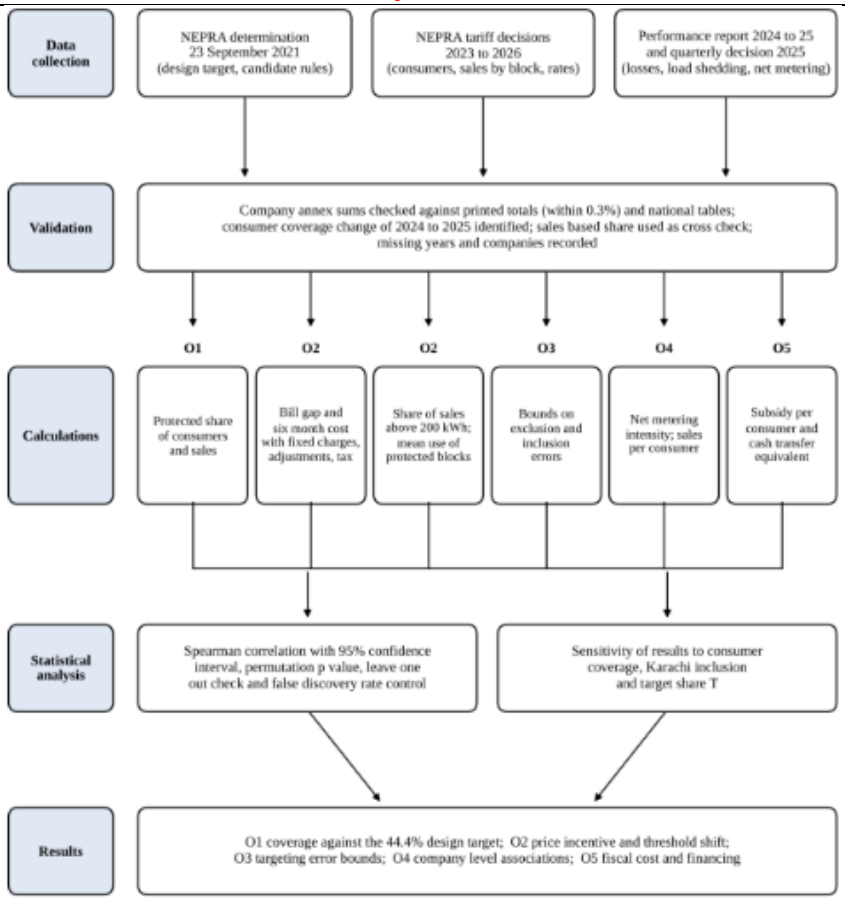

Figure 2. Methodology of the study.

The quantity, data, equations and test of each objective are listed in Table 1. As can be seen in Table 1, every objective is measured with data published by the regulator, and objective 2 measures the response to the threshold on the distribution of company sales across tariff blocks, as household consumption is not published.

Table 1. Objectives, data and tests

Objective	Measured quantity	Data	Eq.	Test or benchmark
Coverage	Protected share of consumers and of sales, 2022 to 2026	Consumer counts and sales by slab in the tariff decisions	(1), (2)	Design coverage of 44.4%; sensitivity to coverage and Karachi
Incentive and response	Bill gap and 6 month cost at 190 kWh; share of sales above 200 kWh by company	Notified rates, fixed charges, adjustments and sales tax; company sales by tariff block	(3) to (8)	Spearman correlation with the rise in protection, 10 companies; partial correlation, 9 companies
Targeting errors	Lower bounds on exclusion and inclusion errors	Protected share; target share of 40% from the 2021 determination	(9), (10)	Sensitivity to target shares of 0.35 to 0.50

Company associations	Rank correlation of protection with losses, recovery, load shedding and net metering	Performance report 2024 to 2025; quarterly decision of 2025	(11) to (13)	95% confidence interval and false discovery rate control, 9 companies
Fiscal cost	Subsidy per year and per protected consumer	Subsidy table of the 2026 decision; cash transfer budget	None	Comparison with the cash transfer program

Tariff Incentive Analysis:

The incentive to remain protected is measured as the difference between the monthly bill of a non protected and a protected household at the same consumption q:

$$\Delta(q) = B^U(q) - B^P(q) \quad (3)$$

where $B^U(q)$ and $B^P(q)$ are the monthly bills of a non protected and a protected household, respectively (Rs). For a household within the first 2 slabs, each bill is given by the following equation:

$$B(q) = (1+\tau)[F_s L + r_1 \min(q, 100) + r_2 \max(0, \min(q, 200) - 100) + aq] \quad (4)$$

where r_1 and r_2 are the rates of the 1 to 100 kWh and 101 to 200 kWh slabs, respectively (Rs/kWh), q is the monthly consumption (kWh), F_s is the fixed charge of the slab (Rs/kW per month), L is the sanctioned load (kW), a is the sum of the applicable fuel charge and quarterly adjustments (Rs/kWh) and τ is the sales tax rate. The rates are obtained from the NEPRA decisions that notify the uniform tariff of September 2021, July 2023, October 2024, July 2025 and February 2026 [6][38][39][40][43]. Sales tax is applied at the standard rate of 18%[48]. The fixed charges of the residential slabs up to 200 kWh are introduced only in February 2026, and the charges of the 101 to 200 kWh slab are identical, at Rs 300/kW per month, for protected and non-protected consumers [38]. The provincial electricity duty, removed from bills from July 2025 [49], is not included.

The 6 month rule determines the duration of the penalty. A household whose consumption exceeds 200 kWh in month m fails the eligibility test in each of the months $m+1$ to $m+6$, as month $m$lies within the previous 6 months of each, and regains protection in month $m+7$ if the 6 intermediate months remain at or below 200 kWh. The cost of a single month above the threshold is the sum of the bill gaps over the following 6 months:

$$C_6 = \sum_{j=1}^{6} \Delta(q_{m+j}) = 6\Delta(q) \quad \text{for } q_{m+j} = q \quad (5)$$

where C_6 is the 6 month cost (Rs) and q_{m+j} is the consumption in month $m+j$ (kWh). The multiplication by 6 holds for a household that returns to a constant consumption q after the excursion, and the cost is evaluated at q = 190 kWh, a consumption just below the threshold. A further month above 200 kWh restarts the count, so C_6 is the minimum cost of an excursion, and the bill of the excursion month itself, which is charged at the non protected rates for any household above 200 kWh, is not included.

Threshold Response Analysis:

Following the reported studies of notches[25][26], the shift of residential consumption across the threshold is measured for each company as follows:

$$a_{d,t} = \frac{\sum_{k>200} E^U_{k,d,t}}{E^R_{d,t} - E^{ToU}_{d,t} - E^T_{d,t}} \times 100 \quad (6)$$

where $a_{d,t}$ is the share of non time of use residential sales above 200 kWh (%), $E^U_{k,d,t}$ is the sales of the non protected slab k above 200 kWh (GWh), and $E^{ToU}_{d,t}$ and $E^T_{d,t}$are the time of

use and temporary supply sales, respectively (GWh). A movement of households below the threshold reduces $a_{d,t}$. Moreover, the sales of protected consumers are reported by tariff block, and the protected bill is telescopic, so the mean monthly consumption of the 2 protected groups is recovered from the national table of 2025[40] as follows:

$$\bar{q}_1 = \frac{E_1 - 1200N_2}{12N_1} \tag{7}$$

$$\bar{q}_2 = \frac{E_2}{12N_2} + 100 \tag{8}$$

where $\bar{q}_1$ and $\bar{q}_2$ are the mean monthly consumption of the protected consumers in the 1 to 100 kWh and 101 to 200 kWh slabs, respectively (kWh), E_1 and E_2 are the annual sales in the first and second protected blocks, respectively (kWh), and N_1 and N_2 are the corresponding numbers of consumers.

The share $a_{d,t}$ is a property of the billed sales and not of individual households. Its link with the threshold is tested across companies: a response to the notch concentrates the fall in $a_{d,t}$ where entry into protection is largest. A fall in $a_{d,t}$ can also arise from four other sources. First, weather differs between years: seasonal variation within a year is removed by the annual totals, whereas a hotter or cooler year shifts the whole distribution. Second, load shedding removes supply hours and lowers the billed consumption of all households on the affected feeders[18][42]. Third, rooftop solar systems lower grid purchases: approximately 17 GW of solar modules were imported in 2024[50], and the net metered capacity reached approximately 6.1 GW by June 2025 [51]. Fourth, consumer prices rose by 29.2% and 23.4% in the fiscal years 2023 and 2024 and by 4.5% in 2025 [52][53]and the cumulative fall in real income lowers demand, with low income households the most price elastic [14]. Each of the 4 sources can lower $a_{d,t}$ in every company, and load shedding and solar generation vary across companies, so the test also holds the losses, the reported load shedding and the net metering intensity constant in turn. Moreover, the use of multiple meters to remain below the threshold was raised at the 2025 hearing and was not disputed by the Ministry [40]. Furthermore, the protected share of sales and the share above 200 kWh are not independent, as a fall in the sales above 200 kWh lowers the denominator of the protected share of sales. The response is reported as an association, and the four sources are discussed with the results.

Targeting Error Estimation:

Lower bounds on the 2 error types follow from the coverage alone. Let N be the number of residential consumers, P the set of protected consumers with $|P| = cN$, and G the target group with $|G| = TN$, where c and T are the protected share and the target share, respectively. The protected members of the target group cannot exceed the smaller of the 2 sets, $|P \cap G| \leq \min(cN, TN)$. The exclusion error, defined as the share of the target group that is not protected, satisfies

$$\varepsilon_x = \frac{|G| - |P \cap G|}{|G|} \geq \frac{T - c}{T} \quad \text{for } c < T \tag{9}$$

and the inclusion error, defined as the share of protected consumers outside the target group, satisfies

$$\varepsilon_i = \frac{|P| - |P \cap G|}{|P|} \geq \frac{c - T}{c} \quad \text{for } c > T \tag{10}$$

where ε_x and $\varepsilon_i$are the exclusion and inclusion errors, respectively. The bounds hold with equality only when the smaller set lies entirely within the larger, i.e., $P \subseteq G$ for $c < T$ and

$G \subseteq P$ for $c > T$, which requires protection to follow a perfect ranking by income. For example, with $c = 0.588$ and $T = 0.40$, at least 0.188 of all consumers are protected and outside the target group, which is 32.0% of the protected consumers. The protected share c is a share of meters, so T must also be expressed as a share of meters.

The target share is taken as $T = 0.40$, the bottom 40% named by the Ministry [6] which assumes one meter per household. The Ministry, however, equated the 11.04 million protected meters of the adopted rule with the 11 million households of the bottom 40% [6]which corresponds to $T = 0.444$ in meters. Both values are reported, and the bounds are also evaluated for T between 0.35 and 0.50.

The bounds are defined over meters, and the errors at the level of households can differ from them in both directions. Three cases depart from one meter per household. First, a meter shared by several households records their combined consumption, so poor households on a shared meter are more likely to exceed 200 kWh, which raises the household exclusion error above the meter bound. Second, a household with multiple connections can hold 2 or more protected meters, which raises the protected share of meters above the protected share of households; the meter bound then overstates the share of protected households outside the target group, whereas the additional meters themselves deliver subsidy outside the target. Third, a vacant or seasonally occupied property records very low consumption and is protected without any household to target, which raises the meter inclusion error and also inflates the number of meters. The extent of each case cannot be measured from the regulatory record, so the bounds are interpreted as bounds on the allocation of protected meters and not of protected households.

Statistical Analysis:

The national shares are computed from complete enumerations of billed consumers and not from samples, so sampling confidence intervals do not apply to them. The uncertainty of the shares arises from the reporting and the coverage of the tables, and it is evaluated with 3 reliability checks. First, the company annexes are checked against the printed totals and the national tables, with agreement within 0.3%. Second, the protected share of residential sales, which is unaffected by the change in the consumer totals, is compared with the protected share of consumers. Third, the share of consumers in 2025 and 2026 is recomputed on the 2024 coverage under the 2 extreme assumptions that all additional consumers are protected or that none is protected.

The association between the protected share and the company characteristics is measured with the Spearman rank correlation ρ. The sample is small, 10 companies for the threshold response and 9 companies for which performance data are published by the regulator, so each coefficient is reported with a 95% confidence interval obtained from the Fisher transformation with the variance of Bonett and Wright [54]:

$$z = \tanh^{-1}\rho, \qquad SE = \sqrt{\frac{1 + \rho^2/2}{n - 3}} \tag{11}$$

$$CI_{95} = \tanh(z \pm 1.96\,SE) \tag{12}$$

where z is the transformed coefficient, $SE$is its standard error and n is the number of companies. The threshold response of objective 2 is the primary comparison, and its p value is also obtained from a permutation test with 200,000 random permutations, together with a leave one out check in which each company is removed in turn. The 12 company level comparisons of objective 4 are exploratory, and the false discovery rate across them is controlled with the method of Benjamini and Hochberg [55], reported as the adjusted value

q. With 9 and 10 companies, a coefficient of approximately 0.67 and 0.63, respectively, is required for significance at the 5% level, so only strong associations can be detected, and the absence of significance does not demonstrate the absence of an association. Moreover, the primary comparison is repeated over the 9 companies with performance data as a partial Spearman correlation, controlling in turn for the losses, the reported load shedding and the net metering intensity, with p values from 100,000 permutations and confidence intervals from the same transformation with $n - 4$ in place of $n - 3$. The variables are the losses, recovery and reported daily load shedding for 2024 to 2025 [42].

Data are missing for 3 reasons, and no values are imputed. First, no comparable national count of protected consumers is available for 2023, and company level sales by protected slab are available for 2024, 2025 and 2026 only. Second, the Hazara company reports separately from 2025 only, so it is excluded from the comparisons of change, and the Peshawar change from 2024 to 2026 compares a footprint that includes Hazara with one that does not, an effect covered by the leave one out check. Third, the performance report does not cover the Tribal Areas and Hazara companies, which limits the company level comparisons to 9 companies.Moreover, the role of net metered solar generation, examined for Mexico in [35], is measured by the net metering intensity of each company:

$$n_d = \frac{X_d}{P_d} \times 100 \tag{13}$$

where n_d is the net metering intensity (%), X_d is the energy exported by net metered consumers and P_d is the energy purchased by the company, both for January to March 2025 (GWh) [44]. Furthermore, following the outage study of [36]the residential sales per consumer of each company for 2024 to 2025 are compared with the daily load shedding reported for the same year [42]. The residential sales are taken from the decision of July 2024 [39] for the same year.

Results:

Design of the Protected Category:

The protected category was created by a NEPRA determination dated 23 September 2021, on the policy guidelines of the Federal Government approved by the Economic Coordination Committee as the first phase of a three-phase subsidy reform [6]. In the guidelines, protected consumers are defined as non-time-of-use residential consumers consuming 200 kWh or less per month consistently for the past 6 months. Moreover, the lifeline category is extended to consumers whose maximum consumption over the past 12 months and current month does not exceed 100 kWh, and the 301 to 700 kWh slab is divided into 4 slabs [6]. At creation, the change carried no financial impact on consumers, as identical rates were applied to protected and non-protected consumers in the 1 to 100 kWh and 101 to 200 kWh slabs [6].

Table 2. Candidate eligibility rules, 2021 [6]

Rule	Share of consumption protected (%)	Share of meters protected (%)	Meters protected
Average of 12 months below 200 kWh	53.51	75.49	18,762,982
Average of 6 months below 200 kWh	55.49	74.87	18,609,671
Maximum of 6 months below 200 kWh (adopted)	18.36	44.41	11,038,157
Maximum of 12 months below 200 kWh	11.77	35.72	8,878,606

Table 2 shows the 4 candidate eligibility rules presented by the Ministry to the

regulator. The rules based on average consumption would have protected approximately three quarters of meters, whereas the rules based on maximum consumption would have protected between 36% and 44%. The six-month maximum rule is selected by the Ministry as the rule closest to the 11 million households in the bottom 40% [6]. A 12-month average is recommended by the Ministry of Planning and by a commentator at the hearing, for the reduction of exclusion due to seasonal consumption peaks [6].

The design figures in Table 2 serve as the benchmark for the evaluation in this paper. The adopted rule is projected to protect 44.4% of meters, accounting for 18.4% of residential consumption.

Coverage Against the Design Target:

As shown in Table 3, the national counts of protected consumers are obtained from the regulatory decisions. The total number of residential consumers changes from 28.80 million in 2024 to 33.67 million in 2025, which exceeds normal growth and indicates a change of coverage between the tables. Due to the change in coverage, the shares are compared across years, whereas the counts are not.

Table 3. Protected residential consumers, 2022 to 2026 [38][39][40]

Year	Protected consumers	Residential consumers	Protected share (%)	Protected sales (GWh)	Source
2022	7,856,737	28,212,910	27.8	6,872	[38]
2024	15,553,918	28,804,861	54.0	14,413	[39]
2025	18,985,787	33,666,385	56.4	15,857	[40]
2026	20,170,487	34,274,946	58.8	18,905	[38]

The protected share of residential consumers from 2022 to 2026 is depicted in Figure 3. As shown in Figure 3, the protected share started below the design coverage of 44.4% and rose above it within 2 years. In 2026, a protected share of 58.8% is recorded, and the number of protected consumers (20.17 million, based on the wider coverage of the 2026 table) is 1.83 times the 11.04 million projected in 2021. The average consumption of a protected consumer remains between 70 kWh and 78 kWh per month in all years, which shows the newly protected consumers to be low consumption consumers similar to the original protected population.

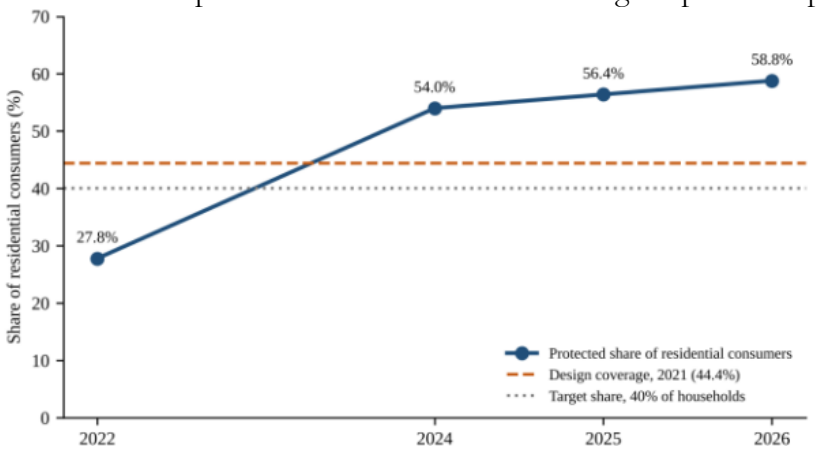

Figure 3. Protected share of residential consumers [6][38][39][40].

The three reliability checks support the trend. The protected share of residential sales, which does not depend on the consumer totals, rises from 28.4% in 2024 to 30.8% in 2025 and 36.6% in 2026, in the same direction as the share of consumers. Moreover, when the 4.86 million additional consumers in 2025 are removed, the 2025 share on the 2024 coverage is 49.0% if all of them were protected and 65.9% if none were protected.

The corresponding range for 2026 is 51.0% to 70.0%. The design coverage of 44.4% is therefore exceeded from 2025 onward under any allocation of the additional consumers.

Furthermore, with 3.8 million K-Electric consumers included, the national share of 2026 lies between 53.0% and 63.0% for any protected share of the Karachi consumers, and it would fall to the design coverage only if Karachi had more than 11.2 million residential consumers with none protected. Consequently, the exclusion of Karachi does not change the conclusion that the design coverage is exceeded.

Over the same period, the total residential sales remain nearly constant at 52.4 TWh, 50.8 TWh and 51.7 TWh in 2022, 2024 and 2026, respectively[38][39]. Moreover, the average consumption per residential consumer falls from 155 kWh per month in 2022 to 147 kWh in 2024 on comparable coverage, and to 126 kWh in 2026, part of which reflects the wider coverage of the later tables. Consequently, the number of residential consumers increases, whereas their total billed consumption remains nearly unchanged.

Tariff Incentive:

The notified rates of the first 2 slabs and the resulting bill gap are listed in Table 4. As can be seen in Table 4, no price difference is carried by the category at its creation, as identical rates of Rs 7.74/kWh and Rs 10.06/kWh are notified for protected and non protected consumers in September 2021 [6]. In July 2023, the non protected rates are raised to Rs 16.48/kWh and Rs 22.95/kWh, whereas the protected rates are held unchanged [43]. Consequently, a gap in the variable charge of Rs 2,034 per month is obtained for a household consuming 190 kWh, which rises to Rs 2,622 per month in October 2024 [39] and remains at Rs 2,621 per month in July 2025 [40] and February 2026 [38]. With sales tax included, the monthly gap is Rs 2,400 in July 2023 and Rs 3,093 in July 2025, and the 6 month cost of a single month above 200 kWh is Rs 14,401 and Rs 18,557, respectively.

Table 4. Rates and bill gap at 190 kWh [6][38][39][40] [43]

Period	Protected 1 to 100 (Rs/kWh)	Protected 101 to 200 (Rs/kWh)	Non protected 1 to 100 (Rs/kWh)	Non protected 101 to 200 (Rs/kWh)	Gap (Rs)	Gap with tax (Rs)	Six month cost (Rs)
Sep 2021	7.74	10.06	7.74	10.06	0	0	0
Jul 2023	7.74	10.06	16.48	22.95	2,034	2,400	14,401
Oct 2024	11.69	14.16	23.59	30.07	2,622	3,094	18,563
Jul 2025	10.54	13.01	22.44	28.91	2,621	3,093	18,557
Feb 2026	10.54	13.01	22.44	28.91	2,621	3,093	18,557

The full bills of the two households under the February 2026 schedule are listed in Table 5 for a sanctioned load of 1 kW. As can be seen in Table 5, the fixed charge and the periodic adjustments are identical for the 2 households at 190 kWh, so the difference in their bills arises entirely from the variable charge and the sales tax applied to it. The fuel charge adjustment of December 2025 excludes only the lifeline, electric vehicle charging and prepaid consumers [46], and the quarterly adjustment of December 2025 to February 2026 excludes only the lifeline and prepaid consumers [47]. Earlier, protected consumers were excluded from the monthly fuel charge adjustments [45], and the gap in a given month therefore varied according to the adjustment applied to non-protected consumers. For the adjustment of −Rs 1.79/kWh for July 2025 [45], the gap at 190 kWh is narrowed by Rs 400 per month with tax, which is 13% of the gap. Moreover, below 100 kWh the fixed charge differs between the slabs, at Rs 200/kW for protected and Rs 275/kW for non protected consumers [38], which adds Rs 75 per kW of sanctioned load to the gap.

Table 5. Monthly bill at 190 kWh, February 2026

Component	Protected (Rs)	Non protected (Rs)	Gap (Rs)
Fixed charge (1 kW)	300.0	300.0	0.0
Variable charge	2,224.9	4,845.9	2,621.0

Fuel charge adjustment (Rs 0.2841/kWh)	54.0	54.0	0.0
Quarterly adjustment (Rs 0.3298/kWh)	62.7	62.7	0.0
Sales tax (18%)	475.5	947.3	471.8
Total	3,117.0	6,209.8	3,092.8

Figure 4 shows that the monthly bill gap at 190 kWh rises from zero at the time of the category's introduction to Rs 2,034 by July 2023 (Rs 2,400 including tax) and stabilizes at Rs 2,621 (Rs 3,093 including tax) from October 2024. In July 2023, a non protected household pays 2.2 times as much as a protected household for the same 190 kWh, and the ratio remains 2.2 in 2025. Moreover, the introduction of the incentive preceded the observed coverage growth: coverage was 27.8% in 2022 and 54.0% in 2024, following the opening of the bill gap in July 2023. During the hearing of July 2023, the Ministry also stated that no increase was proposed for lifeline and protected consumers, which together formed approximately 46% of all consumers [43].

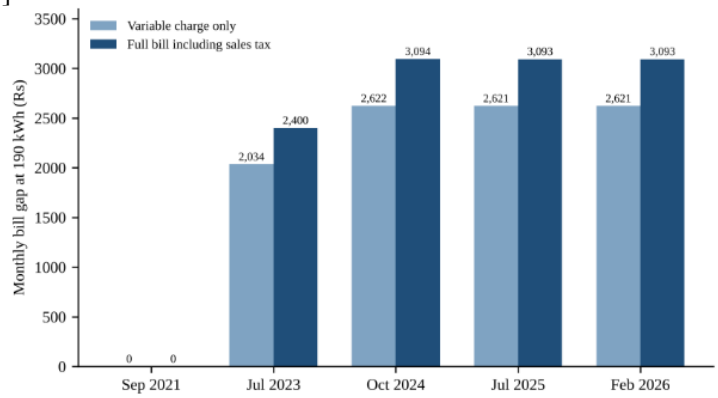

Figure 4. Monthly bill gap at 190 kWh[6][38][39][40][43].

The structure of the notch at 200 kWh is depicted in Figure 5 for the notified rates of July 2025 [40]. As depicted in Figure 5, the monthly variable charge of a protected household consuming 200 kWh is Rs 2,355, whereas a non protected household consuming the same amount is charged Rs 5,135. A household crossing the threshold in a single summer month faces the non-protected tariff schedule for the following six months, thereby converting a temporary seasonal peak into a sustained increase in electricity charges. Furthermore, the base tariff increases of 2021 to 2025 are borne almost entirely by non protected households.

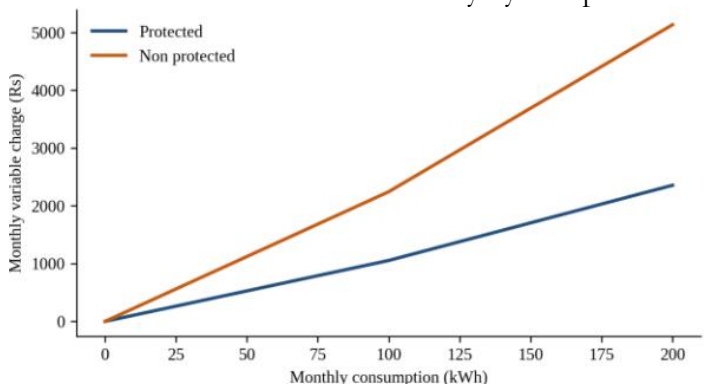

Figure 5. Monthly variable charge against consumption [40].

Consumption Shift Below the Threshold:

The share of residential sales above 200 kWh is listed for each company in Table 6. As can be seen in Table 6, the national share falls from 46.0% in 2024 to 45.7% in 2025 and 39.1% in 2026. The share falls in 9 of the 10 companies with data for both years, and the largest falls are observed in the Sukkur and Peshawar companies, of 18.2 and 15.3 points, respectively. Only the Tribal Areas company shows a rise, of 3.3 points.

Table 6. Share of residential sales above 200 kWh [38, 39, 40]

Company	2024 (%)	2025 (%)	2026 (%)	Change (points)
Sukkur (SEPCO)	33.5	30.4	15.3	−18.2
Peshawar (PESCO)	45.1	41.7	29.9	−15.3
Multan (MEPCO)	42.0	42.3	35.7	−6.2
Faisalabad (FESCO)	45.4	45.7	39.7	−5.7
Lahore (LESCO)	52.2	52.1	47.1	−5.1
Hyderabad (HESCO)	30.9	34.4	25.9	−5.0
Islamabad (IESCO)	50.7	51.4	46.9	−3.8
Gujranwala (GEPCO)	49.7	50.5	46.2	−3.5
Quetta (QESCO)	37.0	36.6	35.5	−1.5
Tribal Areas (TESCO)	60.9	60.1	64.2	3.3
All companies	46.0	45.7	39.1	−6.9

The relation between the fall in the share above 200 kWh and the rise in the protected share is depicted in Figure 6. It can be seen in Figure 6 that the companies with the largest fall above the threshold are the companies with the largest rise in protection (Spearman −0.87, 95% confidence interval −0.98 to −0.43, p = 0.001, 10 companies). The permutation test gives p = 0.002, and the coefficient remains between −0.82 and −0.98 when any single company is removed. Moreover, across the 9 companies with performance data, the fall above 200 kWh is not detectably associated with the losses (ρ = −0.33, 95% confidence interval −0.82 to 0.44, p = 0.381), the reported load shedding (ρ = 0.08, −0.62 to 0.71, p = 0.831) or the net metering intensity (ρ= −0.12, −0.73 to 0.59, p = 0.765). Its association with the rise in protection remains after controlling for each, with partial ρ = −0.79 (−0.97 to −0.07, p = 0.017), −0.85 (−0.98 to −0.23, p = 0.010) and −0.86 (−0.98 to −0.27, p = 0.007), respectively.

Furthermore, the coefficient is −0.88 with the Peshawar company removed, whose footprint changes with the separation of Hazara. The result remains significant if the primary comparison is added to the 12 exploratory comparisons and all 13 are corrected together (q = 0.015). Thus, the growth of the protected category is accompanied by a shift in residential sales from above to below 200 kWh, as expected for a notch [25][26]. A general fall in demand due to prices, income or weather is not expected to concentrate in the companies where entry into protection is largest, and the fall is not detectably associated with the losses, the reported load shedding or net metered solar export. Nevertheless, part of the association is mechanical, as a fall in the sales above 200 kWh lowers the residential sales on which the protected share is computed, and the company tables do not show which households moved. Consequently, the association does not establish a behavioral response of individual households.

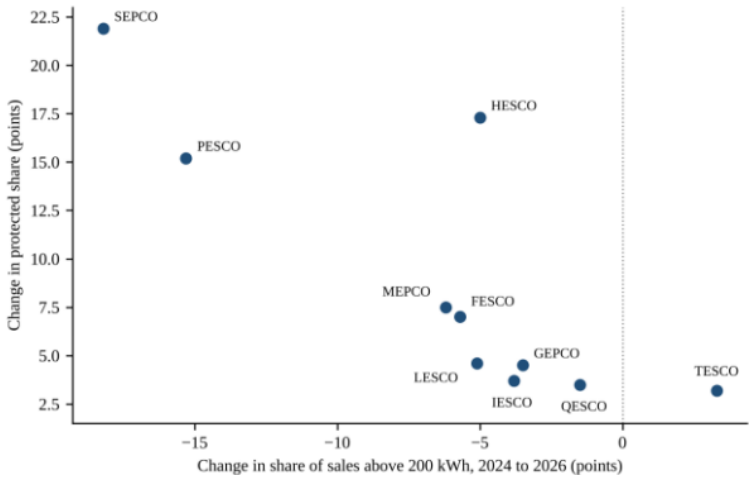

Figure 6. Threshold shift against change in protection [38][39][40].

Furthermore, the mean consumption of the two protected groups in 2025 is obtained as 30.3 kWh per month for the 11.96 million consumers in the 1 to 100 kWh slab and 136.4 kWh per month for the 7.03 million consumers in the 101 to 200 kWh slab. The mean of 30.3 kWh per month is far below the 70 kWh to 78 kWh of the protected population as a whole, which shows that the larger protected group consists of meters with very low billed consumption. Such meters are consistent with suppressed consumption, rooftop solar supply, divided connections and vacant premises; however, the data do not allow these four possibilities to be distinguished.

Targeting Errors:

The lower bounds on the targeting errors are evaluated for each year in Table 7. The results show that at least 30.5% of the target group is excluded in 2022, with 27.8% of consumers protected, even if every protected consumer belonged to the target group. From 2024 onward, the error changes sign: with 58.8% of consumers protected in 2026, at least 32.0% of protected consumers lie outside the bottom 40%, even if every member of the target group is protected. With the meter equivalent of the design target, $T = 0.444$, the bounds are 37.4% for the exclusion error of 2022 and 24.5% for the inclusion error of 2026. As can be seen in Table 7, the sign change holds for target shares between 0.35 and 0.50, and the inclusion bound of 2026 falls to 15.0% only if the target group is taken as half of all meters. With Karachi included, the inclusion bound of 2026 lies between 24.5% and 36.5% for $T = 0.40$ and between 16.2% and 29.5% for $T = 0.444$.

Table 7. Lower bounds on targeting errors [6, 38, 39, 40]

Year	Protected share c (%)	Error type	T = 0.35 (%)	T = 0.40 (%)	T = 0.444 (%)	T = 0.50 (%)
2021 design	44.4	Inclusion	21.2	9.9	0.0	0.0
2021 design	44.4	Exclusion	0.0	0.0	0.0	11.2
2022	27.8	Exclusion	20.6	30.5	37.4	44.4
2024	54.0	Inclusion	35.2	25.9	17.8	7.4
2025	56.4	Inclusion	37.9	29.1	21.3	11.3
2026	58.8	Inclusion	40.5	32.0	24.5	15.0

Consequently, within four years, the category shifts from a regime in which a substantial part of the poor is excluded to one in which a substantial part of the protected population is not poor. Moreover, at the design stage the adopted rule carries a bound of zero for $T = 0.444$, as it was selected to match the size of the target group, and an inclusion bound of 9.9% for $T = 0.40$.

Protection Across Distribution Companies:

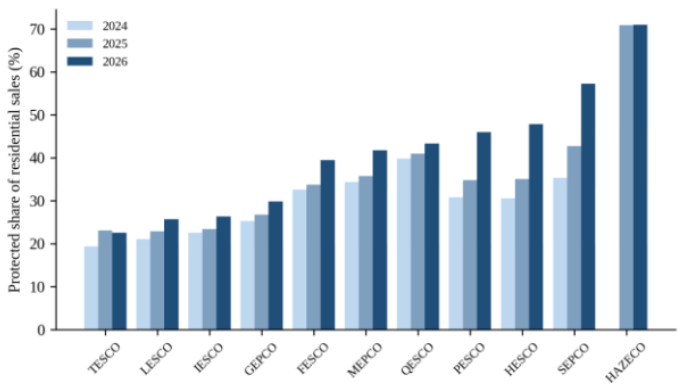

Figure 7. Protected share of residential sales by company[38][39][40].

The protected share of residential sales of each company for 2024, 2025 and 2026 is depicted in Figure 7. It can be seen in Figure 7 that the share rises between 2024 and 2026 in

all 10 companies with data for both years, and only the Tribal Areas company shows a small decline between 2025 and 2026. The largest increases are observed in the Sukkur, Hyderabad and Peshawar companies, from 35.3% to 57.2%, from 30.5% to 47.8% and from 30.8% to 46.0%, respectively. The smallest increases, between 3.2 and 4.6 points, are observed in the Islamabad, Lahore, Gujranwala, Quetta and Tribal Areas companies. Furthermore, the increase in the Peshawar company is observed despite the separation of the Hazara company in 2025. The Hazara company had a protected share of 71.0%, the highest among all companies, and its removal would by itself have lowered the Peshawar share.

As shown in Table 8, the values presented in Figure 7 are listed alongside the protected share of all residential sales up to 200 kWh, which measures how much of the eligible consumption range is already protected. As can be seen in Table 8, protected consumers account for 66.6% of all residential sales up to 200 kWh nationally in 2026, against 57.3% in 2024, and for more than 70% in the Sukkur, Peshawar, Quetta and Hazara companies.

Table 8. Protected share of residential sales by company [38][39][40].

Company	Share 2024 (%)	Share 2025 (%)	Share 2026 (%)	Protected share of sales up to 200 kWh, 2026 (%)	Residential sales 2026 (GWh)	Company
Hazara (HAZECO)	n/a	70.9	71.0	92.5	1,002	Hazara (HAZECO)
Sukkur (SEPCO)	35.3	42.7	57.2	78.5	1,953	Sukkur (SEPCO)
Hyderabad (HESCO)	30.5	35.0	47.8	68.5	2,493	Hyderabad (HESCO)
Peshawar (PESCO)	30.8	34.8	46.0	71.3	4,969	Peshawar (PESCO)
Quetta (QESCO)	39.8	40.9	43.3	75.3	766	Quetta (QESCO)
Multan (MEPCO)	34.3	35.8	41.8	69.2	9,875	Multan (MEPCO)
Faisalabad (FESCO)	32.5	33.7	39.5	68.3	7,262	Faisalabad (FESCO)
Gujranwala (GEPCO)	25.3	26.7	29.8	59.0	6,584	Gujranwala (GEPCO)
Islamabad (IESCO)	22.6	23.4	26.3	59.7	5,512	Islamabad (IESCO)
Lahore (LESCO)	21.1	22.9	25.7	58.2	10,271	Lahore (LESCO)
Tribal Areas (TESCO)	19.4	23.1	22.6	63.9	988	Tribal Areas (TESCO)
All companies	28.4	30.8	36.6	66.6	51,675	All companies

Table 9 shows the rank correlations between the protected share and the company characteristics, with their confidence intervals and adjusted values. The 2026 share is strongly associated with the transmission and distribution losses ($\rho = 0.82$, $p = 0.007$) and with the reported load shedding ($\rho = 0.74$, $p = 0.021$), and negatively associated with recovery ($\rho = -0.67$, $p = 0.049$). However, the confidence intervals are wide with 9 companies, and none of the 12 exploratory comparisons remains significant at the 5% level after false discovery rate control, the strongest being the losses with $q = 0.084$. The correlations with the change from

2024 to 2026 have the same signs but are not significant.

Table 9. Spearman correlations across 9 companies[38][39][40][42][44]

Comparison	ϱ	95% CI	p	q
T&D losses and share 2024	0.67	−0.07 to 0.93	0.050	0.120
T&D losses and share 2026	0.82	0.23 to 0.97	0.007	0.084
T&D losses and change 2024 to 2026	0.47	−0.32 to 0.87	0.205	0.308
Recovery and share 2024	−0.50	−0.88 to 0.29	0.168	0.288
Recovery and share 2026	−0.67	−0.93 to 0.07	0.049	0.120
Recovery and change 2024 to 2026	−0.16	−0.75 to 0.57	0.683	0.745
Load shedding and share 2024	0.59	−0.19 to 0.91	0.092	0.184
Load shedding and share 2026	0.74	0.05 to 0.95	0.021	0.120
Load shedding and change 2024 to 2026	0.33	−0.45 to 0.82	0.391	0.521
Net metering and share 2026	−0.70	−0.94 to 0.03	0.036	0.120
Net metering and change 2024 to 2026	−0.20	−0.77 to 0.54	0.606	0.727
Load shedding and sales per consumer	0.11	−0.60 to 0.72	0.781	0.781

The relation between the 2026 protected share and the transmission and distribution losses is depicted in Figure 8. As shown in Figure 8, the companies form 2 groups. Load shedding of 8 to 10 hours per day in practice is reported by the regulator for the Peshawar, Quetta, Sukkur and Hyderabad companies. The hours reported by the companies themselves are lower and are used in Table 9 and Figure 10. By contrast, almost no load shedding is reported for the Islamabad, Faisalabad, Gujranwala and Lahore companies [42]. The average protected shares of the 2 groups in 2026 are 48.6% and 30.3%, respectively, and the average increases from 2024 are 14.5 and 4.9 points, respectively. The Multan company, with low losses and some load shedding, is not placed in either group.

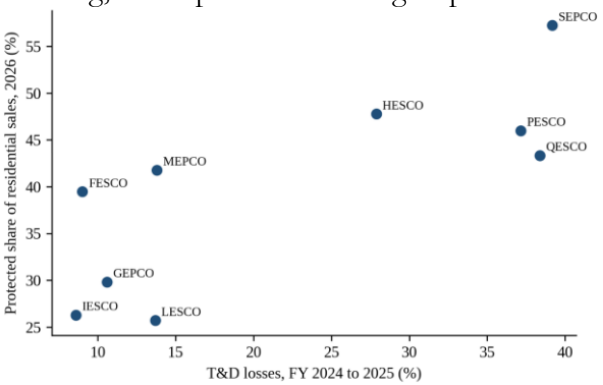

Figure 8. Protected share against T&D losses [38][42].

Net Metered Solar Generation:

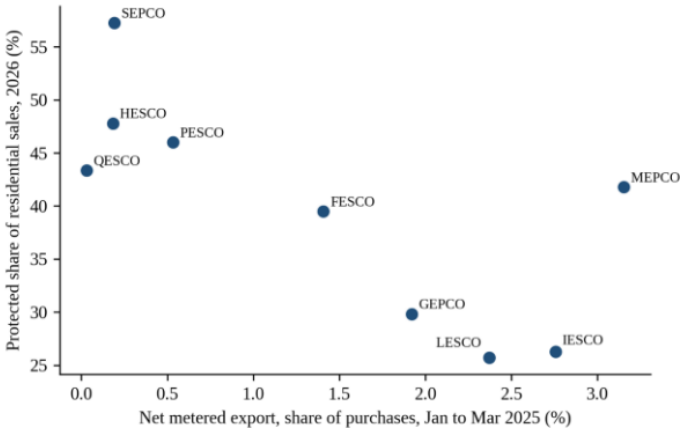

Figure 9. Net metering intensity against protected share[38][44].

The net metering intensity is compared with the protected share in Figure 9. As shown in Figure 9, the net metered export ranges from 0.03% of purchases in the Quetta company to 3.15% in the Multan company, and the intensity is negatively associated with the protected share in 2026 ($\rho = -0.70$, 95% confidence interval −0.94 to 0.03, p = 0.036, q = 0.120). The Lahore, Islamabad and Gujranwala companies, with the highest net metering intensity after Multan, have the lowest protected shares. Whereas, the association between the net metering intensity and the rise in the protected share from 2024 to 2026 is weak ($\rho = -0.20$, p = 0.606). The result differs from the Mexican case [35], in which net metered systems return high consumption households to the subsidized tariff: in Pakistan, net metered generation is concentrated in the companies where protection is lowest.

Load Shedding and Billed Consumption:

The residential sales per consumer are compared with the daily load shedding in Figure 10. As depicted in Figure 10, no relation is observed between load shedding and the billed consumption per consumer across the 9 companies ($\rho = 0.11$, 95% confidence interval −0.60 to 0.72, p = 0.781). The Sukkur and Hyderabad companies have the highest sales per consumer at 171.4 kWh and 153.0 kWh per month, respectively, whereas the Quetta company, with the highest reported load shedding, has the lowest at 77.9 kWh per month. Thus, the comparison across companies does not reproduce the reduction of consumption by outages measured in [36], whereas climate and income differ between the service areas and can mask such a reduction. The Sukkur company has both the highest protected share and the highest sales per consumer, which indicates a polarized distribution with many low consumption meters and a group of high consumption consumers.

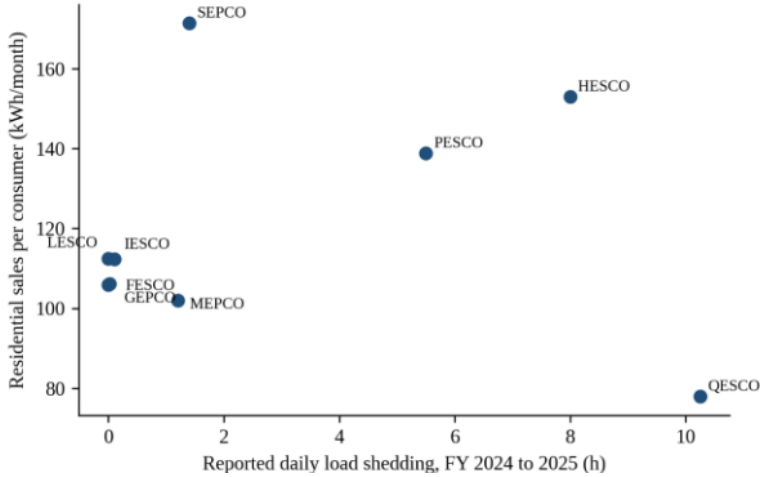

Figure 10. Load shedding against sales per consumer[39][42].

Fixed Charges and Periodic Adjustments:

Fixed charges for protected consumers are introduced for the first time by the decision of February 2026. The fixed charges are levied on the sanctioned load and are as follows: Rs 200/kW per month in the 1 to 100 kWh slab and Rs 300/kW per month in the 101 to 200 kWh slab [38]. The effective rate of a protected household is computed as follows:

$$\bar{r}(q) = \frac{F_s L + r_1 q}{q} \tag{14}$$

where $\bar{r}$ is the effective rate (Rs/kWh), F_s is the fixed charge (Rs/kW per month), L is the sanctioned load (kW), r_1 is the rate of the 1 to 100 kWh slab (Rs/kWh) and q is the monthly consumption (kWh). For a household consuming 50 kWh with a sanctioned load of 1 kW, with F_s = Rs 200/kW and r_1 = Rs 10.54/kWh, the effective rate is Rs 14.54/kWh, which is 38% above the headline rate. Moreover, the fixed charge is regressive within the protected category, as it raises the effective rate most for consumers with the lowest consumption.

Additionally, protected consumers were treated differently in the monthly fuel charge adjustments until late 2025. The negative fuel charge adjustment of Rs 1.7856/kWh for July 2025 is applied to all consumers except the lifeline, protected, electric vehicle charging and prepaid consumers [45]. Consequently, the protection operated in both directions: protected consumers were shielded from part of the cost increases, and refunds were withheld from them. From the adjustment of December 2025, the exclusion no longer names protected consumers [46].

Fiscal Cost and Financing:

The subsidies and cross subsidies by category in the 2026 decision are depicted in Figure 11. As depicted in Figure 11, a subsidy of Rs 474 billion per year is received by protected consumers, at a cost of service of Rs 36.13/kWh against an applicable rate of Rs 11.05/kWh [38]. Similarly, subsidies of Rs 88 billion, Rs 27 billion, Rs 24 billion and approximately Rs 15 billion are received by non protected consumers up to 200 kWh, the 201 to 300 kWh slab, lifeline consumers and agricultural consumers, respectively. The net subsidy of the Federal Government is Rs 249 billion[38][40]. The remainder is financed through cross subsidies of Rs 381 billion, paid as follows: industrial consumers (Rs 102 billion), residential consumers above 300 kWh and time of use consumers (Rs 93 billion), commercial consumers (Rs 90 billion), bulk consumers (Rs 45 billion), general services (Rs 35 billion) and others (Rs 16 billion).

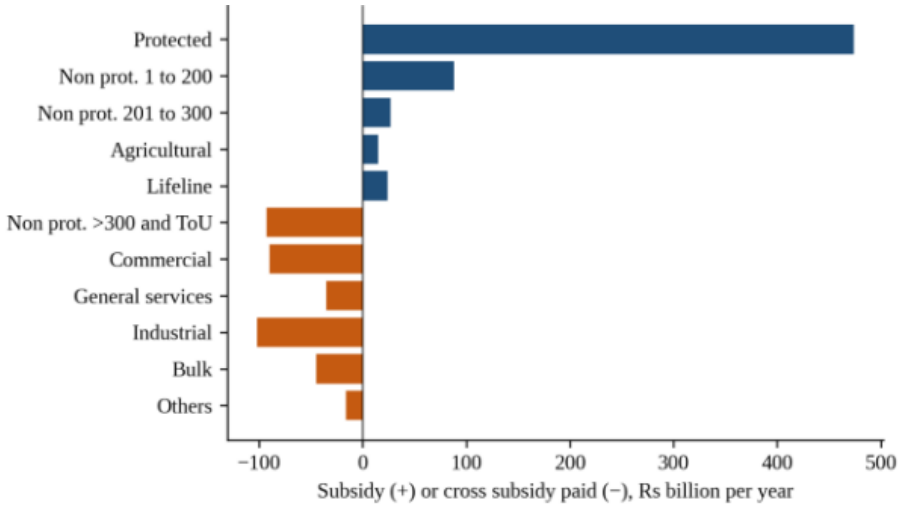

Figure 11. Subsidies and cross subsidies by category, 2026[38].

The protected subsidy amounts to Rs 23,500 per protected consumer per year, or approximately Rs 1,960 per month. The protected subsidy is equal to approximately two thirds of the allocation of Rs 716 billion to the Benazir Income Support Program for 2025 to 2026, which provides quarterly cash transfers of Rs 14,500 to approximately 10.3 million families [56]. If the protected subsidy were paid to the same families as a cash transfer, each family would receive approximately Rs 3,800 per month, which would add approximately 80% to the current transfer of approximately Rs 4,830 per month.

Discussion:

Drivers of Coverage Growth:

The growth of the protected category is consistent with 4 mechanisms, and partial evidence on each is available in the regulatory record. The first mechanism is consumption suppression, i.e., the reduction of monthly consumption by households near the threshold. Once the bill gap reached Rs 2,400 to Rs 3,100 per month with tax, households near the threshold had a strong incentive to keep every month below 200 kWh, and a household that succeeded for 6 months entered the category. The coincidence of the incentive with the coverage growth supports the first mechanism. Moreover, the share of residential sales above

200 kWh falls most where the protected share rises fastest, in agreement with the response of households to the average price under block tariffs [24]and the high price elasticity of low income households in Pakistan [14]. However, the stable average consumption of protected consumers, between 70 kWh and 78 kWh per month, indicates that the new entrants are not concentrated just below the threshold, as a pure bunching response would produce. The billing cycle effects reported for Ethiopia[29] also caution that bunching in monthly bills can be overstated, and bill level data would be required to measure it directly.

The second mechanism is rooftop solar generation. Net metered and self consuming households buy fewer units from the grid, and the billed consumption per residential consumer falls from 155 kWh per month in 2022 to 147 kWh in 2024 on comparable coverage. At the 2025 hearing, a residential net metering capacity of over 5.3 GW is stated by an industrial association [40], and approximately 17 GW of solar modules were imported in 2024 alone [50]. A solar household can enter the protected category due to the reduction of its grid purchases below the threshold, which shifts the subsidy toward households able to afford a solar system [16]. However, net metered export is concentrated in the companies with the lowest protected share and is weakly related to the growth of protection. Net metered systems are therefore not the main source of the growth, and the solar mechanism, if present, operates through systems without net metering, which are not recorded in the regulatory data.

The third mechanism is the division of connections. At the 2021 hearing, a commentator warned that multiple connections would be obtained to benefit from the threshold [6] Similarly, at the 2025 hearing, an industrial association stated that multiple single phase meters are used in many two story houses to exploit the 200 kWh subsidy slab. The Ministry replied that a proposal is under consideration through social protection programs to eliminate the exploitation of the subsidy mechanism [40]. The practice is raised on the regulatory record and not disputed by the Ministry, whereas its extent cannot be measured from that record. The growth of residential consumers by 21.5% between 2022 and 2026 is consistent with it, whereas the comparison is affected due to the change of coverage in the residential consumer totals.

The fourth mechanism is load shedding. Supply is removed from high loss feeders for several hours per day under loss based load shedding [42] which mechanically reduces the billed consumption and keeps more households below 200 kWh in the companies where it is applied. The company level results are consistent with the fourth mechanism, as the protected share in 2026 averages 48.6% in the 4 companies with heavy load shedding against 30.3% in the 4 companies with almost none, and the average increase from 2024 is 14.5 points against 4.9 points.

However, the association does not remain significant after false discovery rate control. Moreover, the same companies have the highest losses, the lowest recovery and the poorest service areas, so load shedding cannot be separated from income or from unbilled consumption. Furthermore, the residential sales per consumer show no relation with load shedding across the companies, and the rebound of household demand after outages observed in Lahore[18] indicates that the effect of load shedding on monthly consumption is not a simple reduction. Due to the confounding of load shedding, income and unbilled consumption, the result is presented as an association that warrants investigation with feeder level data.

Comparison with International Studies:

The protected category is compared in Table 10 with the consumption based and household based designs reported in the literature, by eligibility basis, benefit and reported problems. As can be seen in Table 10, leakage to households that are not poor is reported for the designs based on metered consumption in Sub Saharan Africa, Ethiopia and Vietnam[2][3][19] and for the design based on connection capacity in Indonesia [31].

Similarly, the adaptation of metering arrangements, through shared and multiple connections, is reported in Sub Saharan Africa and Ethiopia[2][3], which matches the multiple meters raised at the 2025 hearing in Pakistan [40]. Moreover, a behavioral response to the eligibility threshold is reported in [26][27][28]which matches the shift of residential consumption below 200 kWh observed in Pakistan. Furthermore, the Pakistani rule is unusual in 2 respects: eligibility depends on a sequence of the household's own monthly readings, and the price difference between eligible and ineligible households for the same consumption is large.

The household based designs of South Africa and Iran avoid the endogeneity of eligibility, whereas they require a registry of eligible households [32][34], which is the direction proposed by the Government of Pakistan [6][40].

Table 10. Electricity subsidy designs in developing countries

Country	Eligibility basis	Benefit	Reported problems	Source
Pakistan, protected category	200 kWh or less in each of the previous six months	Lower rates on the first 200 kWh, exemption from most base tariff increases	Coverage above design target, multiple meters raised at hearing	This work
Sub Saharan Africa	Lifeline blocks on metered consumption	Lower rates on first block	Multiple connections and meter sharing	[2]
Ethiopia, Addis Ababa	Increasing block tariff on metered consumption	Lower rates on low blocks	Poorest quintile received 7% of subsidy, shared connections	[3]
Vietnam	Increasing block tariff on metered consumption	Below cost first blocks	Ineffective support of the poor	[19]
Indonesia	Connection capacity of 450 VA and 900 VA	Subsidized tariff for small connections	Subsidy captured by higher deciles	[30][31]
South Africa	Registration as indigent household	50 kWh per month free	Distortion of cooking fuel choice toward electricity	[32][33]
Iran	Universal	Cash transfer replacing price subsidies	Transfer eroded by inflation	[34]
Thailand	Monthly consumption below 50 kWh	Zero bill for the month	Bunching below the threshold	[26]
Brazil	Household income	Discount on consumption brackets	Under consumption near the brackets	[27]
Mexico	Average consumption over 12 months above a regional limit	Exit from the subsidized tariff	Return to the subsidy through photovoltaic systems	[35]

Data Quality:

The evaluation also reveals the limits of the public record. The residential consumer totals change by 4.9 million between the 2024 and 2025 tables without explanation, which indicates a change of coverage. Moreover, the counts of non protected consumers below 200 kWh are reported as 8.40 million and 2.39 million in 2025 and 2026, respectively, whereas the sales to the same group are nearly identical at 9.7 TWh and 9.5 TWh, respectively. The sales in the tables are reported by tariff block, whereas the consumers are reported by slab, so the sales of a row cannot be divided by its consumers to obtain an average consumption [38][40]. The conflicting counts of non protected consumers are not used in this paper. A subsidy of Rs 474 billion per year cannot be audited consistently from the published figures, and a consistent annual table of consumers and sales by category, with a fixed definition of coverage, would make independent evaluation possible.

Policy Implications:

The results lead to 3 implications. First, a consumption threshold that is held fixed while the price gap across it grows attracts consumers into the protected category, and the category drifts away from its target group over time. The design figures of 2021 described a rule with no price gap, and the figures ceased to describe the rule once the gap opened. Second, a single seasonal peak is converted by the 6 month rule into 6 months of non protected billing. The rule penalizes households in hot regions and large households with fluctuating consumption, as anticipated by the Ministry of Planning in 2021 [6]. The company level results show that hot regions are not excluded in practice, and the rule remains volatile for households near the threshold. Third, the scale of the protected subsidy is comparable to the national cash transfer program, and the intention of moving the subsidy to the socioeconomic registry has been stated by the Government itself [6][40]. The Government has since committed to replacing the protected subsidy with a registry-linked transfer from January 2027 [7], and a revision of the 6 month rule, under which a month above 200 kWh is billed at the non protected rate for that month only, is under consideration[57]. The results quantify the potential value of the transfer: approximately Rs 3,800 per month for each enrolled family, delivered to households identified by a proxy means test rather than by their electricity meters.

Design Options:

Four design options follow from the results, and each option can be evaluated with data already held by the distribution companies. First, the 6 month maximum rule can be replaced with a 12 month average, as proposed by the Ministry of Planning in 2021 [6], which reduces the penalty for a single seasonal peak. However, the Ministry's own figures place the resulting protected population at 75% of meters, so the change requires a lower threshold. Second, the price difference across the threshold can be tapered, so that crossing 200 kWh raises the price of the units above the threshold and not of all units. The tapered schedule removes the notch and, with it, the incentive to suppress consumption or divide connections. Third, protection can be linked to the national socioeconomic registry through the national identity number of the account holder, which was described by the Ministry as the third phase of the reform in 2021[6]. The registry link allows one protected connection per household and removes the incentive for multiple meters. Fourth, the subsidy can be paid as a cash transfer through the existing social protection program, which separates income support from electricity pricing entirely. The present subsidy would fund approximately Rs 3,800 per month for each enrolled family. The 4 options differ in administrative demand and political feasibility, and their effects cannot be simulated household by household from the regulatory record. Nevertheless, each option addresses one of the 4 mechanisms of the protected category growth, and the choice among the options depends on the dominant mechanism, which can be established from feeder and account level data.

Limitations:

The study is based on administrative tables published by the Government and the regulator, which carry inconsistencies in coverage and in the counts of non protected consumers, and the sales in the tables are projections for the tariff year and not measured household consumption. The shares are used in place of the counts wherever the coverage changes, and the conclusions are checked against the extreme allocations of the additional consumers. The targeting bounds are defined over meters, and the household level errors can differ in both directions due to shared meters, multiple connections and vacant properties. The company-level analysis is based on 9 observations. Its associations do not survive false discovery rate control, and it cannot separate the competing mechanisms. Moreover, the threshold result is partly mechanical, and a check with the company protected share of consumers would remove the shared denominator. Furthermore, the bill comparisons exclude the provincial electricity duty charged until June 2025, and the bill gap in the months before December 2025 varies with the fuel charge adjustment from which protected consumers were excluded.

Conclusions:

In summary, we have evaluated the protected residential electricity category of Pakistan against its 2021 design target, using official regulatory documents alone. The category is designed to protect 44.4% of residential consumers, whereas the reported protected share is 27.8% and 58.8% in 2022 and 2026, respectively, and the design coverage is exceeded from 2025 onward under any allocation of the change in consumer coverage and with or without Karachi. The growth follows a price gap that rises from zero to Rs 3,093 per month at 190 kWh with tax, which is a cost of Rs 18,557 for the 6 months that follow a single month above 200 kWh. The derived share of residential sales above 200 kWh falls from 46.0% to 39.1% between 2024 and 2026, most where protection grows fastest ($\rho = -0.87$, $p = 0.001$), and part of the association is mechanical. The lower bounds of the exclusion and inclusion errors, defined over meters, are obtained as 30.5% to 37.4% in 2022 and 24.5% to 32.0% in 2026, respectively. Moreover, protection is highest where losses and load shedding are highest, whereas net metered solar export is concentrated where protection is lowest, and the company level associations are exploratory. The protected subsidy of Rs 474 billion per year, equal to approximately two thirds of the national cash transfer budget, is financed mainly through cross subsidies. A consumption threshold with a growing price gap cannot hold a fixed target group, and the results inform the replacement of the category with a registry based transfer in January 2027.

Acknowledgment:

The authors acknowledge the National Electric Power Regulatory Authority for the public availability of the tariff decisions and performance evaluation reports utilized in this study.

Declarations:

Author contributions: All authors have contributed significantly to this work and are in agreement with the content of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

Originality: This manuscript has not been published or submitted to any other journal.

Funding: No specific funding was received for this work.

Data availability: The data analyzed in this study are publicly available in the NEPRA determination, decisions and performance evaluation report [6][38][39][40][42][43][44][45][46][47] and in the geoBoundaries database [37].

References:

[1] C. Trimble, N. Yoshida, and M. Saqib, "Rethinking Electricity Tariffs and Subsidies in Pakistan," *Rethink. Electr. Tarif. Subsid. Pakistan*, Jul. 2011, doi: 10.1596/19456.

[2] "(PDF) Making Power Affordable for Africa and Viable for Its Utilities." Accessed: Oct. 20, 2026. [Online]. Available: https://www.researchgate.net/publication/316147737_Making_Power_Affordable_for_Africa_and_Viable_for_Its_Utilities?__cf_chl_tk=TifgGYEfTDXpBmvXFIT3x8DrBSrgsAidY5R7imMFkP0-1792480039-1.0.1.1-OE2Zn2N0PoWeqxWzY6jbU3EeNG_buyxPb1kNya2FHTM

[3] H. Cardenas and D. Whittington, "The consequences of increasing block tariffs on the distribution of residential electricity subsidies in Addis Ababa, Ethiopia," *Energy Policy*, vol. 128, pp. 783–795, May 2019, doi: 10.1016/J.ENPOL.2019.01.033.

[4] T. Walker, E. Canpolat, F. K. Khan, and A. Kryeziu, "Residential electricity subsidies in Pakistan : targeting, welfare impacts, and options for reform," *Policy Res. Work. Pap. Ser.*, Dec. 2016, Accessed: Oct. 20, 2026. [Online]. Available: https://ideas.repec.org/p/wbk/wbrwps/7912.html

[5] A. Feltenstein and B. K. Datta, "Broad-based subsidies or targeted transfers? Distributional equity vs macroeconomic costs," *J. Econ. Policy Reform*, vol. 25, no. 3, pp. 211–228, 2022, doi: 10.1080/17487870.2020.1785299.

[6] "National Electric Power Regulatory Authority, Determination of the Authority in the matter of policy guidelines under Section 31 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 regarding re targeting power sec".

[7] "Pakistan assures IMF of replacing 200-unit power subsidy with BISP-linked system - Profit by Pakistan Today." Accessed: Oct. 20, 2026. [Online]. Available: https://profit.pakistantoday.com.pk/2026/05/07/pakistan-assures-imf-of-ending-subsidy-for-consumers-using-up-to-200-electricity-units-from-jan-2027

[8] S. A. Khalid and V. Salman, "'Welfare impact of electricity subsidy reforms in Pakistan: A micro model study,'" *Energy Policy*, vol. 137, Feb. 2020, doi: 10.1016/j.enpol.2019.111097.

[9] R. Ilyas, K. Hussain, M. Z. Ullah, and J. Xue, "Distributional impact of phasing out residential electricity subsidies on household welfare," *Energy Policy*, vol. 163, Apr. 2022, doi: 10.1016/j.enpol.2022.112825.

[10] M. Z. Jan, K. Ullah, F. Abbas, H. A. Khalid, and T. M. Bajwa, "Barriers to the adoption of social welfare measures in the electricity tariff structure of developing countries: A case of Pakistan," *Energy Policy*, vol. 179, Aug. 2023, doi: 10.1016/j.enpol.2023.113648.

[11] R. Ilyas, H. U. Khan, and A. Rauf, "Welfare Impacts of Policy Reforms: A Case of Electricity Subsidies in Pakistan," *Int. J. Energy Econ. Policy*, vol. 12, no. 3, pp. 41–49, 2022, Accessed: Oct. 20, 2026. [Online]. Available: https://ideas.repec.org/a/eco/journ2/2022-03-5.html

[12] G. Samad, N. Faraz, and H. S. Awan, "Tariff differential subsidy (TDS) effects and welfare gains in Pakistan," *Indian Econ. Rev.*, vol. 57, no. 2, pp. 373–392, Dec. 2022, doi: 10.1007/S41775-022-00150-Z.

[13] A. Awan, F. Bilgili, and D. B. Rahut, "Energy poverty trends and determinants in Pakistan: Empirical evidence from eight waves of HIES 1998–2019," *Renew. Sustain. Energy Rev.*, vol. 158, Apr. 2022, doi: 10.1016/j.rser.2022.112157.

[14] M. Aslam and E. Ahmad, "Untangling electricity demand elasticities: Insights from heterogeneous household groups in Pakistan," *Energy*, vol. 282, p. 128827, Nov. 2023, doi: 10.1016/J.ENERGY.2023.128827.

[15] F. Mehmood, M. Umar, C. Dominguez, and H. Kazmi, "The role of residential distributed energy resources in Pakistan's energy transition," *Energy Policy*, vol. 167, Aug. 2022, doi: 10.1016/j.enpol.2022.113054.

[16] A. Amirali, "State and capital in Pakistan's rooftop solar transition," *Geoforum,*, doi: https://doi.org/10.1016/j.geoforum.2026.104738.

[17] K. Ahmed, A. Khalique, and B. Khan, "Solar energy transition under IMF conditionality: Distributive justice and energy policy imperative in Pakistan," *Energy Policy*, vol. 210, Mar. 2026, doi: 10.1016/j.enpol.2026.115070.

[18] H. Kazmi, F. Mehmood, and M. Shah, "Quantifying residential energy flexibility potential for demand response programs using observational data from grid outages: Evidence from Pakistan," *Energy Policy*, vol. 188, p. 114094, May 2024, doi: 10.1016/J.ENPOL.2024.114094.

[19] L. Do and T. H. Le, "On the welfare effect of retail electricity subsidy in Vietnam," *J. Econ. Dev.*, vol. 25, no. 4, pp. 286–301, Nov. 2023, doi: 10.1108/JED-02-2023-0034/FULL/PDF.

[20] "Project MUSE - A Reappraisal of Electricity Subsidies and Household Welfare in Brunei Darussalam." Accessed: Oct. 20, 2026. [Online]. Available: https://muse.jhu.edu/pub/70/article/855256/pdf

[21] O. Bertín, T. García, F. Pizzi, A. Porto, J. Puig, and J. Puig, "Energy subsidies: conceptual framework and measurement for distributional impacts in Argentina," *Energy Sustain. Dev.*, vol. 83, p. 101557, Dec. 2024, doi: 10.1016/J.ESD.2024.101557.

[22] A. Muktarbek kyzy and F. Alfnes, "Household energy responses to the introduction of increasing block tariffs on residential electricity in Kyrgyzstan," *Energy Policy*, vol. 203, Aug. 2025, doi: 10.1016/j.enpol.2025.114629.

[23] Y. Kou, S. Hirmer, P. Yang, A. Leonard, and F. Egli, "Assessing grid affordability for universal electricity access in Sub-Saharan Africa," *Nat. Commun. 2026 171*, vol. 17, no. 1, pp. 8455-, Jul. 2026, doi: 10.1038/s41467-026-75104-7.

[24] K. Ito, "Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Pricing," *Am. Econ. Rev.*, vol. 104, no. 2, pp. 537–563, Feb. 2014, doi: 10.1257/AER.104.2.537.

[25] H. J. Kleven, "Bunching," *Annu. Rev. Econom.*, vol. 8, no. 1, pp. 435–464, Oct. 2016, doi: 10.1146/ANNUREV-ECONOMICS-080315-015234.

[26] T. Apaitan, T. Tosborvorn, and W. Wibulpolprasert, "Bunching for Free Electricity," *PIER Discuss. Pap.*, 2020, Accessed: Oct. 20, 2026. [Online]. Available: https://ideas.repec.org/p/pui/dpaper/136.html

[27] B. M. Marcoje, L. Schiavon, M. Hallack, D. C. Machado, and M. W. de Abreu, "Impact evaluation of the social electricity tariff program in Brazil: Evidence from a regression discontinuity design," *Energy Policy*, vol. 213, p. 115143, Jun. 2026, doi: 10.1016/J.ENPOL.2026.115143.

[28] Z. Fang, T. H. Le, J. Yu, and M. Fan, "Evaluating Causal Effects of Increasing Block Pricing Policy on Residential Electricity Consumption in China," *Manag. Decis. Econ.*, vol. 46, no. 3, pp. 1661–1676, Apr. 2025, doi: 10.1002/MDE.4466.

[29] T. Hadush Meles and G. Köhlin, "Do Consumers Respond to Marginal Prices at Kink Points? Evidence From 40+ Million Electricity Bills in Ethiopia," *Oxf. Bull. Econ. Stat.*, 2026, doi: 10.1111/OBES.70110;WGROUP:STRING:PUBLICATION.

[30] P. J. Burke and S. Kurniawati, "Electricity subsidy reform in Indonesia: Demand-side effects on electricity use," *Energy Policy*, vol. 116, pp. 410–421, May 2018, doi: 10.1016/j.enpol.2018.02.018.

[31] R. K. Gobel, B. S. Laksmono, M. Huseini, and M. Siscawati, "Equity and Efficiency: An Examination of Indonesia's Energy Subsidy Policy and Pathways to Inclusive Reform," *Sustain. 2024, Vol. 16, Page 407*, vol. 16, no. 1, p. 407, Jan. 2024, doi: 10.3390/SU16010407.

[32] M. Howells, D. G. Victor, T. Gaunt, R. J. Elias, and T. Alfstad, "Beyond free

electricity: The costs of electric cooking in poor households and a market-friendly alternative," *Energy Policy*, vol. 34, no. 17, pp. 3351–3358, 2006, Accessed: Oct. 20, 2026. [Online]. Available: https://ideas.repec.org/a/eee/enepol/v34y2006i17p3351-3358.html

[33] Y. Ye, S. F. Koch, and J. Zhang, "Determinants of household electricity consumption in South Africa," *Energy Econ.*, vol. 75, pp. 120–133, Sep. 2018, doi: 10.1016/j.eneco.2018.08.005.

[34] Z. Zarepour and N. Wagner, "Cash instead of subsidy: Assessing the impact of the iranian energy subsidy reform on households," *Energy Policy*, vol. 168, Sep. 2022, doi: 10.1016/j.enpol.2022.113145.

[35] G. Grande, J. Islas, and M. Rios, "Technical and economic analysis of Domestic High Consumption Tariff niche market for photovoltaic systems in the Mexican household sector," *Renew. Sustain. Energy Rev.*, vol. 48, pp. 738–748, Jul. 2015, doi: 10.1016/j.rser.2015.04.038.

[36] S. Khanna and K. Rowe, "The long-run value of electricity reliability in India," *Resour. Energy Econ.*, vol. 77, Apr. 2024, doi: 10.1016/j.reseneeco.2024.101425.

[37] D. Runfola *et al.*, "geoBoundaries: A global database of political administrative boundaries," *PLoS One*, vol. 15, no. 4, Apr. 2020, doi: 10.1371/JOURNAL.PONE.0231866.

[38] "National Electric Power Regulatory Authority, Decision of the Authority in the matter of Federal Government motion and policy guidelines for rationalization of tariff of XWDISCOs and K Electric, TRF 100, Islamabad - Google Search." Accessed: Oct. 20, 2026. [Online]. Available: https://www.google.com/search?q=38.+National+Electric+Power+Regulatory+Authority%2C+Decision+of+the+Authority+in+the+matter+of+Federal+Government+motion+and+policy+guidelines+for+rationalization+of+tariff+of+XWDISCOs+and+K+Electric%2C+TRF+100%2C+Islamabad

[39] "National Electric Power Regulatory Authority, Decision of the Authority in the matter of motion filed by the Federal Government with respect to recommendation of consumer end tariff, TRF 100".

[40] "National Electric Power Regulatory Authority, Decision of the Authority in the matter of motion filed by the Federal Government under Section 7 and 31(7) of the NEPRA Act 1997 with respect to recommendation of consumer end tariff, TRF 100".

[41] "KE releases sustainability report 2025, reaffirms drive for resilient, inclusive energy future." Accessed: Oct. 20, 2026. [Online]. Available: https://www.app.com.pk/national/ke-releases-sustainability-report-2025-reaffirms-drive-for-resilient-inclusive-energy-future/

[42] "National Electric Power Regulatory Authority, Performance Evaluation Report of Distribution Companies FY 2024 to 25", [Online]. Available: https://nepra.org.pk/M&E/PER/Distribution/2026/PER 2024-25 Distribution Companies.pdf

[43] "National Electric Power Regulatory Authority, Decision of the Authority in the matter of motion filed by the Federal Government under Section 7 and 31(7) of the NEPRA Act 1997 with respect to recommendation of consumer end tariff, TRF 100", [Online]. Available: https://nepra.org.pk/tariff/Tariff/Ex-WAPDA DISCOS/2026/Decision of the Authority Motion of Federal Govt. 1004-23 dated 12.01.2026.PDF

[44] "National Electric Power Regulatory Authority, Decision of the Authority in the matter of requests filed by XWDISCOs for periodic adjustment in tariff for the 3rd

quarter of FY 2024 to 25, TRF 100", [Online]. Available: https://nepra.org.pk/tariff/Tariff/Ex-WAPDA DISCOS/2025/TRF-100 XWDISCOs 3rd QTR FY 2024-25 09-05-2025 5808-11.PDF

[45] "National Electric Power Regulatory Authority, Decision of the Authority in the matter of fuel charges adjustment for the month of July 2025 for Ex WAPDA DISCOs", [Online]

[46] "National Electric Power Regulatory Authority, Decision of the Authority in the matter of fuel charges adjustment for the month of December 2025 for XWDISCOs, Islamabad", [Online].

[47] "Government of Pakistan, Ministry of Energy (Power Division), S.R.O. 2408(I)/2025, quarterly adjustment for the 1st quarter of FY", [Online]. Available: https://ke.com.pk/wp-content/uploads/2025/12/SRO-2408I-2025-Dated-10-12-2025.pdf

[48] "Federal Board of Revenue, The Sales Tax Act, 1990, Section 3, amended up to 30 June 2025, Islamabad, 2025. - Google Search." Accessed: Oct. 20, 2026. [Online].

[49] "The News, Centre ends provincial electricity duty on power bills from July 1, 30 June 2025. https://www.thenews.pk/latest/1325669-centre-ends-provincial-electricity-duty-on-power-bills-from-july-1 - Google Search", [Online].

[50] "From crisis to clean energy: Pakistan emerges as top solar market in 2024 - Markets - Business Recorder." Accessed: Oct. 20, 2026. [Online]. Available: https://www.brecorder.com/news/40357512/from-crisis-to-clean-energy-pakistan-emerges-as-top-solar-market-in-2024

[51] E. Bellini, "Pakistan unveils new net metering rules for rooftop PV", [Online]. Available: https://www.pv-magazine.com/2025/12/18/pakistan-unveils-new-net-metering-rules-for-rooftop-pv/

[52] "State Bank of Pakistan, Press release on the Annual Report 2022 to 23 on the state of the economy, Karachi", [Online]. Available: https://www.sbp.org.pk/assets/document/publications/HalfYear-FY23_1.pdf

[53] "State Bank of Pakistan, Press release on the Annual Report 2024 to 25 on the state of the economy, Karachi", [Online]. Available: https://archive.sbp.org.pk/press/2025/Pr-17-oct-2025.pdf

[54] D. G. Bonett and T. A. Wright, "Sample size requirements for estimating Pearson, Kendall and Spearman correlations," *Psychometrika*, vol. 65, no. 1, pp. 23–28, 2000, doi: 10.1007/BF02294183/METRICS.

[55] Y. Benjamini and Y. Hochberg, "Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing," *J. R. Stat. Soc. Ser. B Stat. Methodol.*, vol. 57, no. 1, pp. 289–300, Jan. 1995, doi: 10.1111/J.2517-6161.1995.TB02031.X.

[56] "First Lady Asifa Bhutto Zardari briefed on Benazir Income Support Programme." Accessed: Oct. 20, 2026. [Online]. Available: https://www.app.com.pk/national/first-lady-asifa-bhutto-zardari-briefed-on-benazir-income-support-programme/

[57] MuhammadMahmood., "Protected electricity consumers likely to get relief on using more than 200 units," *Pakistan*, [Online]. Available: https://pakobserver.net/protected-electricity-consumers-likely-to-get-relief-on-using-more-than-200-units/



Copyright © by authors and 50Sea. This work is licensed under Creative Commons Attribution 4.0 International License.