SAARC WEBINAR

Solar Net-Metering: Challenges and Way Forward

Net Metering in Pakistan, 2015–2026: Regime Design, Phase-Wise Growth, Challenges and the Transition to Net Billing

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ABOUT THE SPEAKER

Engr. Syed Faizan Ali Shah, PMP

Electrical Engineer & Power Sector Professional · ~20 years across Pakistan's energy value chain

An accomplished electrical engineer and seasoned power sector professional with almost two decades of experience across **generation, transmission, and distribution** combining technical expertise, strategic leadership, regulatory insight, and project execution, developed through senior roles in public and private institutions and with multilateral and bilateral development partners.

Career Highlights

- Led development and execution of 3 Nos. 100 MW Solar PV plants at Quaid-e-Azam Solar Park under CPEC — technical design, stakeholder coordination, regulatory approvals, and contractual structuring
- Led the Punjab Ujala Solarization Programme (ADB Access to Clean Energy & Investment Program), solarizing ~11,000 public primary schools
- EHV transmission: planning, coordination, and execution oversight of the 500 kV D.G. Khan, 220 kV Shalimar, and 220 kV Dera Murad Jamali substations and allied transmission lines
- Led the SCADA pilot at IESCO and developed its grid modernization roadmap under the GIZ REEE-II programme
- Institutional strengthening: performance evaluation mechanisms for public-sector power entities, and RE workforce curriculum development under TEVTA Punjab and KfW-supported RE hubs

Committees & Policy Roles

- Member, Federal Government's Smart Metering Committee, and leading Digitization initiatives of Power Division
- Member of Federal Steering Committee on Battery Energy Storage Systems
- Member of Generation Planning Committee
- Member, Prime Minister's Solar Committee — policy deliberations on net metering reform, distributed energy resources, and energy transition strategies
- Board member of Distribution utility , Islamabad Electric Supply company (IESCO)

~20 years across Pakistan's energy value chain

3x100MW Solar PV Plants in QA Solar Park Pakistan,CPEC

11,000 Nos. public primary schools solarized (Punjab Ujala)

3 EHV substations led — D.G. Khan (500 kV), Shalimar & Dera Murad Jamali (220 kV)

Academic Qualifications

- M.Sc. Electrical Engineering
- B.Sc. Electrical Engineering
- Certified Project Management Professional (PMP)

ROADMAP

Contents

FOUNDATIONS

Three Ways to Pay for Exported Solar Power

Distributed solar policy design hinges on one question: how is electricity a prosumer sends to the grid valued? Pakistan has used — or debated — all three models below.

1

Feed-in Tariff (FiT)

Contract-based, gross

All electricity generated not just the surplus is sold to the utility at a fixed, government-set rate for a long-term contract (often 15–25 years), independent of the prosumer's own consumption.

Generally, not allowed to change the installed capacity

2

Net Metering

Pakistan, 2015–2025

A single bi-directional meter nets exports against imports, typically 1:1. Surplus exported in a billing cycle is credited at the same retail rate the consumer pays the model NEPRA (regulator) adopted in 2015.

Monthly / Quarterly

3

Net Billing

Pakistan, from Feb 2026

Imports and surplus exports are metered and priced separately. Exported units are compensated at a lower reference/avoided-cost rate (e.g. a national average energy purchase price), while imports are still billed at the full retail tariff.

Monthly basis

MECHANICS OF NET METERING

Quarterly Settlement: How Credit Tracks Pakistan's Seasons

Net metering settles in three-month quarters, not annually — and Pakistan's weather pattern means most quarters build credit while one quarter spends it.

THE SETTLEMENT RULE

Q1 Jan – Mar → **Q2** Apr – Jun → **Q3** Jul – Sep → **Q4** Oct – Dec

Within each 3-month quarter, exported units offset imported units 1:1. Any surplus remaining at quarter-end converts into a monetary (Rs) credit it does not carry forward as banked units into the next quarter.

Per quarter

kWh exported

↔ *unit-to-unit*

kWh imported

Leftover surplus → Rs credit

THE SEASONAL PATTERN

Q1 Jan–Mar

Winter into spring

▲ **Credit builds**

Cool temperatures, clear skies — generation strong while cooling demand stays low.

→

Q2 Apr–Jun

Shoulder 2 → early summer

▲ **Credit builds, then tapers**

Spring shoulder in April carries surplus forward; heat begins building through May–June.

→

Q3 Jul–Sep

Peak summer

▼ **Credit consumed**

Extreme heat and peak humidity push national peak demand to its highest point of the year — cooling load surges and banked credit is drawn down.

→

Q4 Oct–Dec

Shoulder 1

▲ **Credit builds**

Post-monsoon, mild weather, strong sun — cooling load falls sharply and surplus rebuilds.

↻ *Pattern repeats each year: Q4 → Q1 → Q2 build credit through the cooler shoulder months; Q3's peak heat and humidity draw it back down.*

POLICY EVOLUTION

Pakistan's Net Metering Framework, 2015–2026

2015

NEPRA issues the (Alternative & Renewable Energy) Distributed Generation & Net Metering Regulations

1 kW–1 MW systems permitted; bi-directional metering; contract term initially 3 years.

2018–21

Contract term extended to 7 years; uptake remains modest

Cumulative capacity stays below ~350 MW through 2021 — growth concentrated in Lahore, Karachi, Islamabad.

2022–24

Explosive uptake as tariffs rise and panel costs collapse

Capacity roughly triples year after year: ~0.7 GW → 1.3 GW → 2.5 GW cumulative by FY24.

2025

NEPRA drafts Prosumer Regulations 2026

Buy-back proposed to fall from ~Rs 22–27/kWh toward Average Energy Purchase Price i.e., Rs 8-10/kWh; net billing drafted for new applicants.

8 Feb 2026

Prosumer Regulations 2026 notified, replacing the 2015 framework

Net billing becomes the default; existing 2015-era agreements honoured until expiry, protected under a Feb 2026 amendment after public backlash.

GROWTH IN CONTEXT

Four Phases Behind Pakistan's Solar Trajectory

Phase 1

2015–2019 · Pre-COVID

- Regulation issued Sep 2015; process and financing still unfamiliar
- Cumulative net-metered capacity remains negligible (not publicly reported before FY20)
- PKR broadly stable (~Rs 101–136/USD); tariffs rising only gradually

Phase 2

2020–2021 · COVID & aftermath

- Supply-chain disruption, but global module prices keep falling
- Cumulative capacity reaches ~347 MW by FY21, up from 190 MW in FY20
- Rupee slips to ~Rs 160/USD; grid tariffs still comparatively low

Phase 3

2021–2023 · PKR depreciation & tariff shock

- Rupee falls from ~Rs 160 to ~Rs 279/USD; a ~75% devaluation (FY21–FY25)
- Base tariffs rise ~140%+ from FY21 to FY24 amid IMF-linked adjustments, and higher capacity charges due to devaluation
- Solar becomes a hedge against both currency and energy risk
- SBP's green financing scheme (6% markup: 4% bank + 2% SBP; tenors up to 5 years) helps offset upfront cost

Phase 4

2023–2025 · Acceleration & policy reset

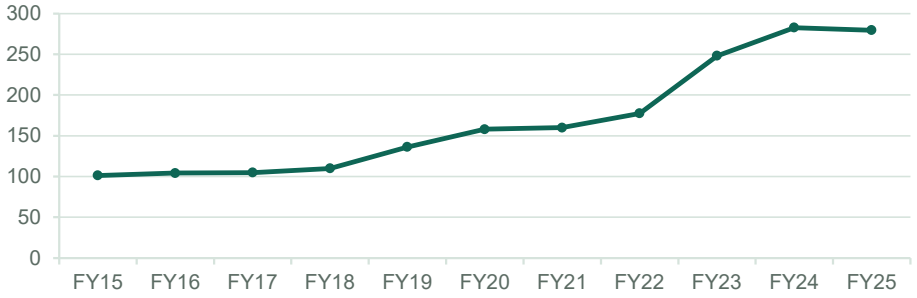
- Import prices fall toward ~10–14 US cents/W on Chinese oversupply
- Net-metered capacity nears 7 GW FY26; imports exceed 17 GW/yr
- Total Solar Panel Imports reached 50GW+
- Industrial, commercial, agricultural, and residential grid demand all decline as solarization accelerates
- Fiscal concerns trigger the shift toward net billing (Feb 2026)

Sector demand decline: Business Recorder analysis of NEPRA State of Industry Report 2024 (industrial below FY18, residential below FY20, agriculture below decade-ago levels). Financing terms: State Bank of Pakistan Refinance Scheme for Renewable Energy.

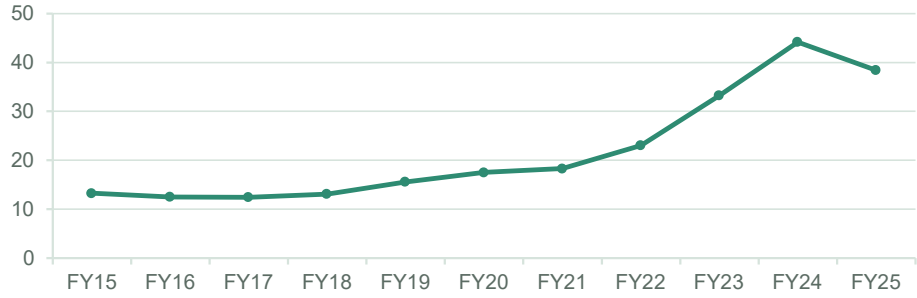
THE UNDERLYING FORCES

Four Curves That Explain the Solar Rush, FY15–FY25

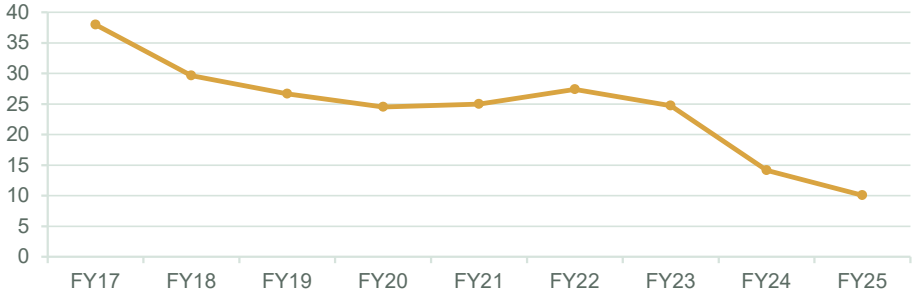
USD to PKR Exchange Rate (PKR per USD, annual avg)



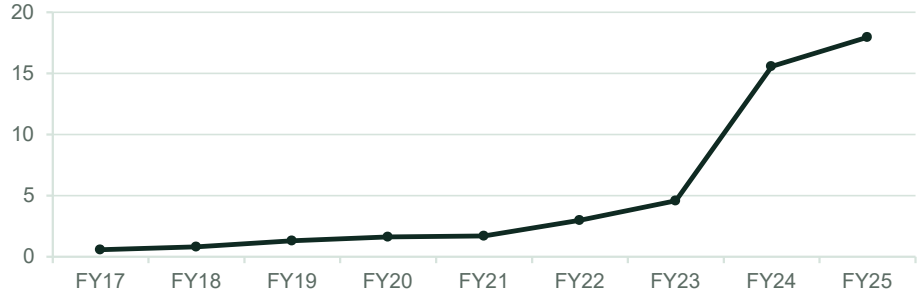
Average Energy Price in Pakistan (Rs per kWh)



Solar Panel Price (Pakistan Imports) (US cents per Watt)



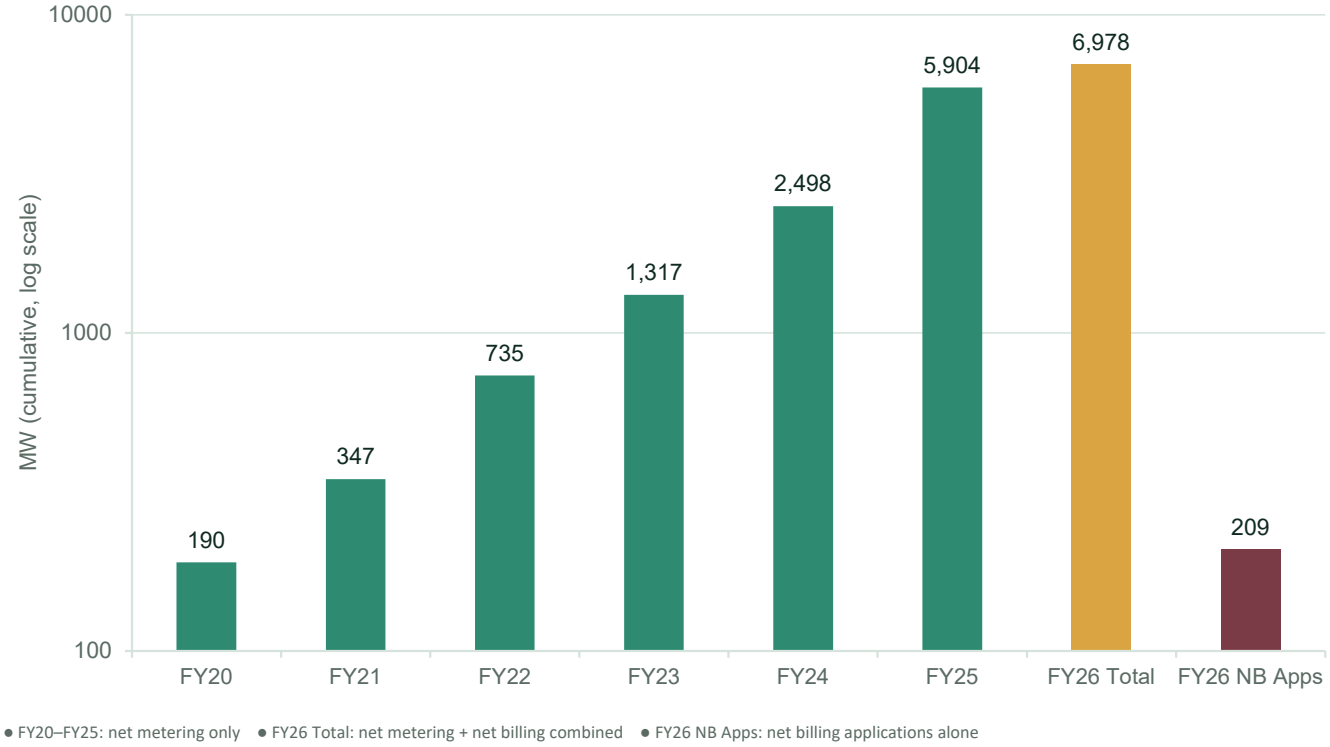
Solar Panel Imports into Pakistan (GW per year)



Pakistan fiscal year (FY) runs July–June. Sources: State Bank of Pakistan (exchange rate); NEPRA State of Industry Reports / energy price ; Ember-Energy Chinese customs export data (solar price & imports)

THE RESULT

Net-Metered Capacity: From 190 MW to Nearly 7 GW



● FY20–FY25: net metering only ● FY26 Total: net metering + net billing combined ● FY26 NB Apps: net billing applications alone

6,978 MW

total distributed-generation capacity (net metering + net billing) by Jun-2026

209 MW

net billing application quantum since the Prosumer Regulations took effect (9 Feb–Jun 2026)

~37x

growth in cumulative capacity over six fiscal years, FY20 → FY26

Note: Figures cover CPPA-G-administered DISCOs; K-Electric's net-metered capacity (estimated ~0.8–1 GW) is not included and would add further to these totals. Source: NEPRA State of Industry Reports; DISCO-wise DG capacity data

SYNTHESIS

Why the Curve Bent Upward After 2021

1

Currency risk became visible

PKR depreciation (~Rs 162 → Rs 280+/USD, 2021–2025) made rupee-denominated grid bills feel increasingly unstable, pushing consumers toward a capital asset that reduces future exposure.

2

Grid tariffs rose faster than incomes

Base tariffs rose ~140%+ from FY21 to FY24 (Rs 18.29 to Rs 44.15/kWh), compressing payback periods for rooftop solar to as little as 3–5 years for many households.

3

Hardware costs fell faster than the rupee weakened

Global module prices dropped from the ~US$0.25–0.35/W range toward US$0.08–0.12/W, more than offsetting currency depreciation in landed PKR/watt terms.

4

Net metering monetised the investment

A 1:1 retail-rate credit for exports meant oversized systems paid for themselves quickly — turning solar from a cost-saving measure into a financial asset, and accelerating adoption further.

GLOBAL RECOGNITION

The World Is Watching: Pakistan as an RE Model

International media, researchers, and financial analysts have increasingly cited Pakistan's rooftop solar boom as a rare, largely organic energy transition — with real lessons, and real risks, for other countries.

Yale Environment 360 *Jul 2025*

Profiles how Pakistan's grassroots rooftop-solar shift is delivering affordable power directly to ordinary households and businesses.

World Resources Institute *2025*

Describes the “perfect storm” of collapsing panel prices and tariff shocks that combined to drive Pakistan's solar surge.

E&E News / POLITICO *Apr 2026*

Asks whether Pakistan's wartime energy resilience — powered by rooftop solar — offers a template other Asian economies could follow.

Corporate Knights *Nov 2025*

Traces how Chinese panel supply combined with grassroots household demand to fuel one of the fastest solar build-outs on record.

4% → 14%

Solar's share of Pakistan's electricity generation, 2021 → 2024 — among the highest in Asia (Reuters analysis of Ember data).

“ A model worth studying ”

Energy Minister Awais Leghari told Reuters the people-led solar shift, alongside nuclear, hydro, and local coal, has strengthened Pakistan's energy self-reliance.

Sources: Yale Environment 360; World Resources Institute; E&E News/POLITICO; Corporate Knights; Reuters/Ember analysis (all publicly reported).

THE OTHER SIDE OF THE BOOM

Challenges of Net Metering

Rapid, largely unmanaged uptake of distributed solar has created two distinct classes of challenge for Pakistan's power system.

Technical Challenges

How high, variable, two-way solar flows strain equipment and operations from the local feeder up to the national transmission system.

Financial Challenges

How 1:1 retail crediting affects DISCO revenue recovery, cross-subsidy burdens, and the long run bankability of the grid.

TECHNICAL CHALLENGES — LOCAL SYSTEM

Distribution System Impacts

Effects that show up at the feeder and consumer level as rooftop solar penetration rises within a single distribution circuit.

1 Over-voltage

Reverse power injection from clustered rooftop systems raises voltage along the feeder, particularly at midday and near the far end of long low-voltage lines risking equipment trips and breaching statutory voltage limits.

2 Low power factor

Many inverters and net-metered installations are not tuned for reactive power support; combined with lighter net loading, this can pull feeder power factor away from DISCO targets and increase system losses.

3 Reverse power flow

When local generation exceeds local demand, power flows backward through distribution transformers and feeders designed for one-way flow complicating protection coordination and tap-changer operation.

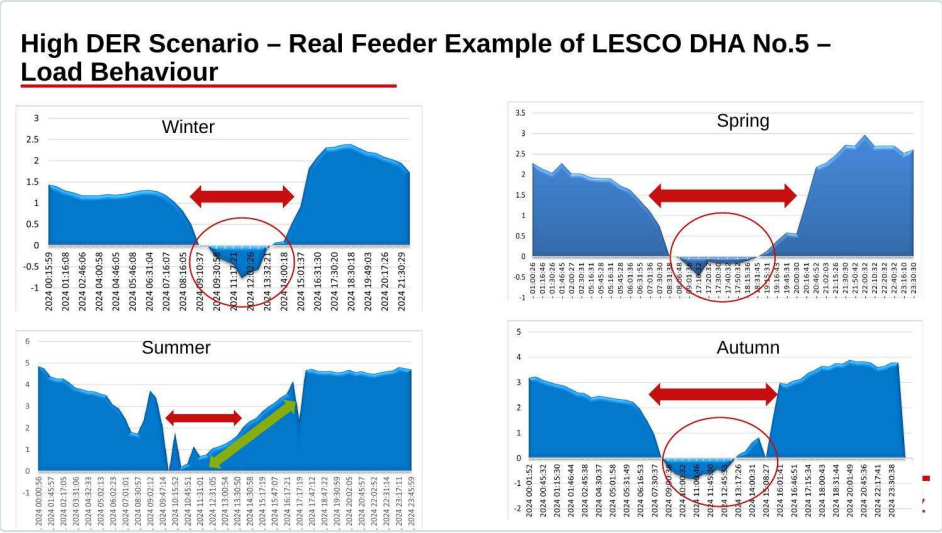
4 Feeder & distribution transformer thermal loading breach

Concentrated solar clusters on a single feeder can overload both the feeder and its distribution transformer beyond rated thermal limits, and complicate fuse/relay coordination sized for unidirectional flow; an emerging concern as adoption clusters in specific circles (Lahore, Karachi, Islamabad).

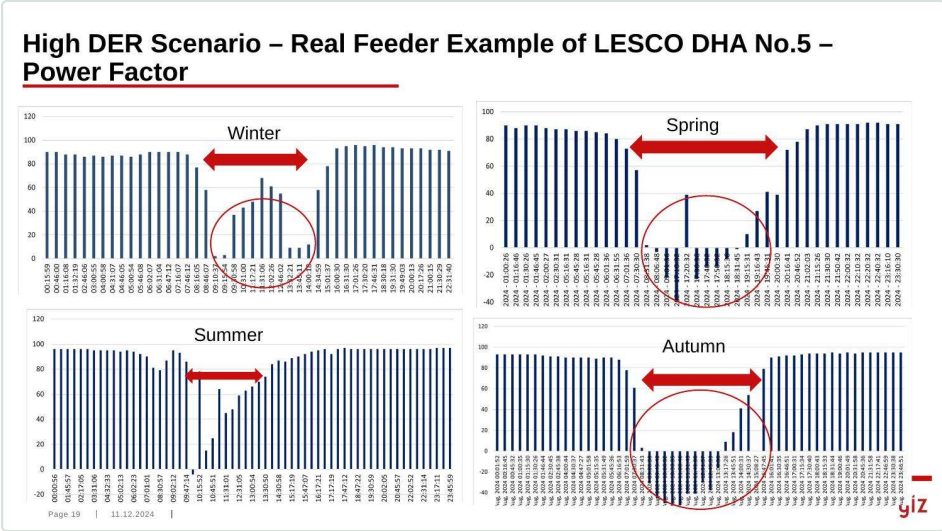
TECHNICAL CHALLENGES — FIELD EVIDENCE

What High DER Penetration Looks Like on a Real Feeder

A high-DER feeder study (LESCO, DHA No.5) tracks the same circuit across all four seasons — showing these are not theoretical effects, but ones already visible in field data.



Seasonal load behaviour, spring/winter/summer/autumn



Seasonal power factor at the same feeder

Reading the data: load and power factor both swing more sharply as DER output rises and falls through the day and across seasons — the same over-voltage and low-power-factor mechanisms described on the previous slide, observed directly on a live LESCO circuit.

Source: "Role of Smart Inverters" presentation, LESCO DHA No.5 feeder study – By Syed Faizan Ali

TECHNICAL CHALLENGES — FIELD EVIDENCE

Why Feeders Trip: The Voltage Cycle Behind Over-Voltage

1 **The condition for export**

For power to flow from a consumer toward the grid, the grid voltage must stay below the inverter's own voltage setpoint (Egrid < E_{inv}).

2 **Reverse flow pushes voltage up**

As solar output rises and power reverses direction on the feeder, Egrid swells and climbs the over-voltage effect described earlier.

3 **The inverter protects itself by tripping**

Once Egrid exceeds E_{inv}, the inverter trips offline, exports stop, and voltage dips back down.

4 **The cycle repeats**

Voltage recovers, the inverter reconnects, exports resume, voltage swells again a repeating rise-trip-dip cycle that is hazardous for both consumer appliances and network infrastructure.

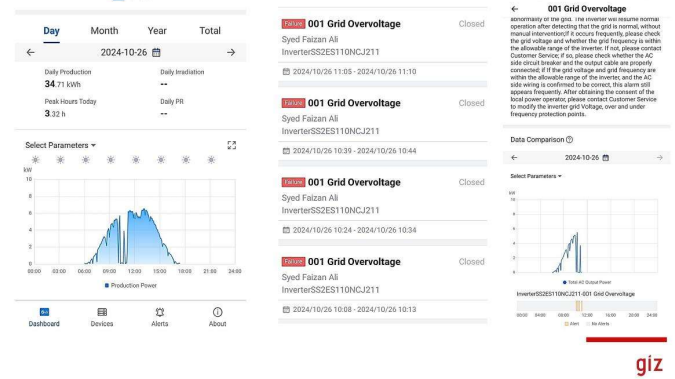
High DER Scenario – Real Feeder Example of LESCO Consumer Over Voltage

Autumn 2024

- For Power to Flow towards grid Egrid < Einv

Einv = Voltage settings of Inverter

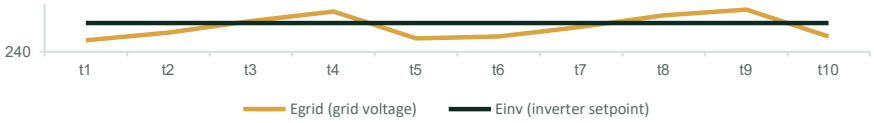
- During reverse power flow Egrid swells and increases
- If Egrid > Einv , the inverter trips and the voltage dips again
- This cyclic process reoccurs and is hazardous for the appliances and the infrastructure



giz

Recorded event — LESCO DHA No.5, autumn 2024

Illustrative: Egrid vs Einv Over Time



Reading the chart, and why it matters

Where amber (Egrid) crosses navy (Einv), the inverter trips and voltage falls, then climbs again. Smart-inverter volt-var and ride-through functions (IEEE 1547-2018) are designed to dampen exactly this cycle rather than trip outright.

TECHNICAL CHALLENGES — NATIONAL SYSTEM

Transmission System Impacts

1 **Day-time minimum demand (low inertia)**

Midday grid demand is suppressed as behind-the-meter solar serves load directly, shrinking the pool of spinning synchronous generation — and with it, system inertia and frequency stability margins.

2 **Quick ramping requirements**

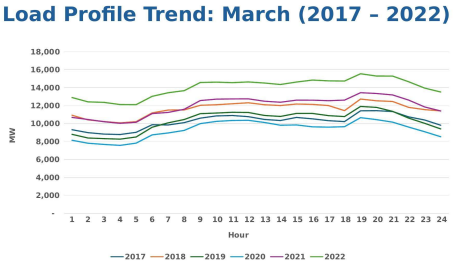
As the sun sets and solar output falls while evening demand rises, conventional plants must ramp up fast and often — a duty many thermal units were not originally dispatched or contracted to provide.

3 **Power swing / the duck curve**

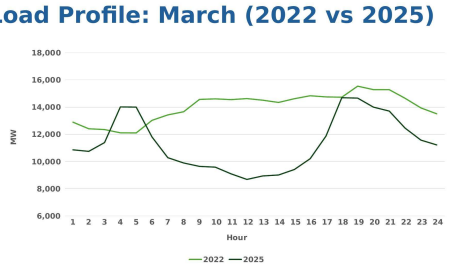
The net-load shape (demand minus solar) develops a deep midday belly and a steep evening neck, the classic “duck curve,” forcing more frequent and larger dispatch swings on the remaining fleet.

4 **Intermittency**

Cloud cover and seasonal variation add short-term volatility on top of the daily pattern, requiring faster reserves and more conservative scheduling margins as distributed solar's grid share grows.



Load profile trend, March 2017–2022



Load profile, March 2022 vs. 2025 (duck curve)

What the curves show

Between 2017–2022, Pakistan's March load profile simply grew year over year. By 2025, the shape itself has changed: mid-day hours (~08:00–14:00) sit well below the 2022 baseline as rooftop solar serves load directly, while early-morning and evening hours stay high or move higher — the signature duck-curve pattern the transmission system must now plan around.

Source: Draft ISP 2026 / ISMO

CHALLENGES — FINANCIAL

Financial Challenges of Net Metering

The 1:1, retail-rate crediting design that made rooftop solar attractive to prosumers is also the source of most financial strain on the grid.

Revenue erosion & cost-shifting

Exports credited at the full retail rate exceed the utility's avoided cost of supply, eroding DISCO revenue and shifting fixed network and capacity costs onto non-solar consumers an estimated ~Rs 101 bn effect in FY2026.

Persistent capacity payment burden

Falling grid electricity sales do not reduce Pakistan's ~Rs 2.5 trillion/year in take-or-pay capacity payments to IPPs, which must still be recovered increasingly from a shrinking base of full-tariff consumers.

Regressive distributional impact

Solar adoption is capital-intensive and concentrated among higher-income, urban households; the resulting cost shift is disproportionately borne by lower-income consumers who cannot afford to install systems of their own.

Buy-back / tariff design misalignment

A flat, retail-parity export rate does not reflect when or where power is actually valuable to the grid — encouraging oversized systems and maximal export rather than self-consumption or demand-side efficiency.

Circular debt & bankability risk

Reduced and less predictable grid sales complicate revenue forecasting for DISCOs and their financiers, feeding into Pakistan's broader circular debt problem and raising the cost of future grid investment.

THE FISCAL QUESTION

What Rapid Uptake Means for Grid Finances

As net-metered capacity grew, so did the debate over who bears the cost of the grid that non-solar consumers still depend on.

~Rs 101 bn

government-estimated DISCO revenue loss attributed to net metering, FY2024

Source: Power Division data, via Geo News / Profit (2025–26)

~US$ 563 mn

cost shift to non-solar consumers estimated by end of 2024

Source: REN21, Global Status Report 2025 (Pakistan snapshot)

~3.2 bn kWh

decline in grid electricity sales during FY2024, partly linked to self-generation

Source: Power Division data, FY2024

Rs 27 → ~Rs 10–13

proposed fall in the per-kWh export buy-back rate, old vs new regime

Two readings of the same numbers

Utility / fiscal view

Net-metered consumers still rely on the grid for backup and reliability, but under 1:1 crediting contribute less toward fixed network costs shifting a growing share of those costs onto consumers without solar.

Prosumer / industry view

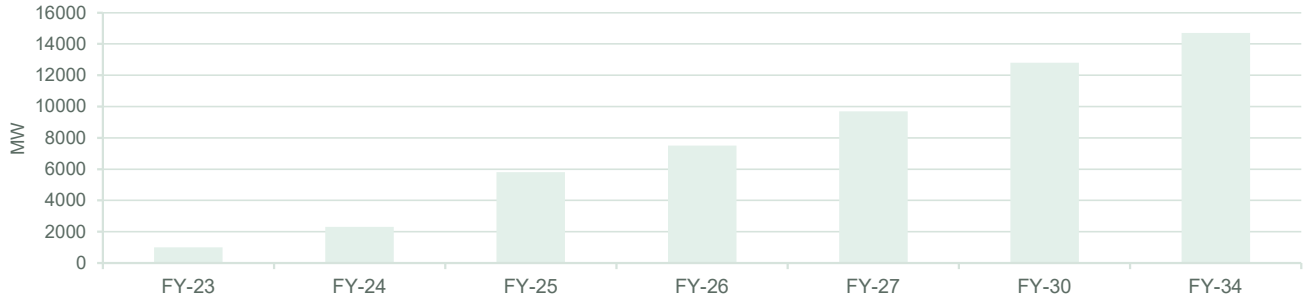
The core problem is structural — transmission losses, weak bill recovery, and expensive capacity payments to idle plants — not consumers who invested under the rules in force when they installed their systems.

THE FISCAL CASE, LOOKING AHEAD

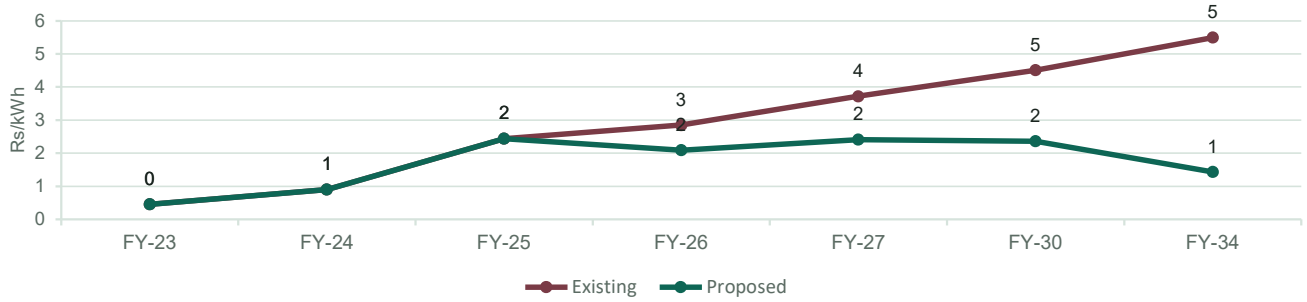
Impact on Non-Net-Metered Consumers

A decade-long projection of what non-solar consumers pay under the existing (net metering) framework versus the proposed (net billing) regime, alongside installed capacity growth.

Installed Capacity



Financial Impact (Rs / kWh)



Cumulative Impact, 2025–34

Existing regulations

Rs 4,472 Bln

cost borne by non-solar consumers if net metering continues unchanged

Proposed regulations

Rs 2,294 Bln

cost borne by non-solar consumers under net billing

~Rs 2,178 Bln

in cost-shifting to non-solar consumers avoided, 2025–34, thanks to the reform

Figures approximate, read from source chart (user-supplied Power Division / Ministry of Energy projection); please verify exact values before external use.

THE TRANSITION

Net Metering vs. Net Billing, Side by Side

	Net Metering (2015 Regulations)	Net Billing (Prosumer Regulations 2026)
Settlement	1:1, single bi-directional meter nets exports vs. imports	Imports and surplus exports (after self consumption) are metered and priced separately and adjusted monthly basis
Export credit rate	Full retail rate (effectively ~Rs 22–27/kWh)	Reference/avoided-cost rate (~Rs 10–13/kWh)
Agreement term	7 years	5 years (extendable by mutual consent)
Maximum installable capacity	Up to 1.5× the consumer's sanctioned load	Capped at 1× the consumer's sanctioned load — no oversizing
System sizing logic	Bigger system = bigger bill offset at retail value	Oversizing exports more units at a lower rate — diminishing returns
Existing contracts	Honoured until expiry under original 2015 terms – conversion to Net Billing upon expiry	Extendable
Payback Period	1-2 years	3-5 years

Prosumer Regulations 2026 notified 8 Feb 2026, replacing the 2015 net metering framework; existing agreements protected until expiry under a subsequent Feb 2026 amendment.

TECHNICAL CHALLENGES — TECHNOLOGY & REGULATORY LAG

Technology Moved Faster Than the Rulebook

~250 W

Standard rooftop panel, 2015

Monofacial · Polycrystalline

Capacity factor: 15–17%

→

700 W+

Standard panel, 2025 — nearly 3x

Bifacial · Mono-crystalline / ABC / HJT

Capacity factor: >20%

Same rooftop area now injects far more power at each connection point — amplifying the voltage-rise and thermal-loading effects noted on the distribution-system slide.

Inverter Standards: From Passive to Smart — On Paper

2003
IEEE 1547-2003 — the baseline most 2015-era net-metered inverters were built to
Fixed power factor, simple trip-on-disturbance behaviour; no active grid-support functions.

2011–12
Indication: Germany's PV "yo-yo effect"
A wave of older, non-smart inverters risked simultaneously disconnecting at 50.2 Hz, exposing the systemic risk of large non-smart inverter fleets — a cautionary parallel, not a Pakistan event.

2018
IEEE 1547-2018 revision mandates smart-inverter functionality
Volt-var control, frequency-watt response, and ride-through become the new global baseline for grid-connected inverters.

Since 2018
Pakistan's net metering regulations were never amended to require it
No mandatory IEEE 1547-2018 / smart-inverter compliance was written into the framework for new connections.

Ongoing
DISCO capacity-building didn't keep pace either
Without SCADA/DERMS integration at the distribution level, even where modern smart inverters are installed, their grid-support functions remain largely unused as of 2026.

TECHNICAL & REGULATORY CHALLENGES — MONITORING

Weak Oversight — and a New Fix Under Net Billing

Beyond equipment and standards, how closely DISCOs actually monitor what's installed and exported has itself been a persistent gap.

Before: loose monitoring

- Installed capacity is often not verified against the DISCO-sanctioned/approved capacity after commissioning
- Systems built larger than the approved limit have generally gone undetected — there was no routine check tying exports back to the sanctioned size

Now: export MDI monitoring

- Alongside the shift to net billing, DISCOs now track a consumer's export Maximum Demand Indicator (MDI) directly from the energy meter
- Exports that consistently run above the sanctioned net-metering capacity are detected from that meter data — discouraging deployment beyond the allowed limit

How it plays out

1. System exceeds sanctioned capacity → **2. Export MDI on the energy meter flags it** → **3. Benefit for the excess units isn't passed on**

Net effect: over-deploying beyond the sanctioned net-metering limit no longer pays off the way it may have under looser, pre-2025 monitoring — the financial upside of oversizing is specifically what the export-MDI check removes.

CASE STUDY — ENERGY SECURITY

Solar's Real-World Stress Test: The April 2026 Gas Shock

When war disrupted Pakistan's main LNG supplier, distributed solar — not new power plants — was what kept the daytime lights on.

28 Feb 2026
US–Israel strikes on Iran begin
The conflict escalates rapidly; Iran retaliates against Gulf energy infrastructure.

2–18 Mar 2026
Qatar's Ras Laffan LNG facility is hit
The world's largest LNG export terminal loses ≈17% of capacity in Iranian strikes.

4 Mar 2026
QatarEnergy declares force majeure
Qatar supply Pakistan's LNG; term cargoes collapse from ~10/month toward zero.

Apr 2026
Pakistan's generation mix is squeezed further
LNG-based output (>21% of the mix) falls from ~6,000 MW capacity to ~500 MW; hydel output also drops as dam releases are prioritised for agriculture.

Result
A ~2,500–3,400 MW shortfall
National demand swings between ~9,000 MW in daytime and ~16,000 MW at night.

☀ DAYTIME

No load shedding

~8,000 MW of net-metered solar fed the grid directly through the shortfall — the Power Division confirmed zero scheduled outages during daylight hours throughout the crisis.

◑ NIGHT-TIME

Load shedding returns

Once solar output stops, hot-weather peak demand near 16,000 MW forced scheduled cuts of up to 2.25 hrs/day (5pm–1am), reaching 6–7+ hours in the hardest-hit areas in mid-April.

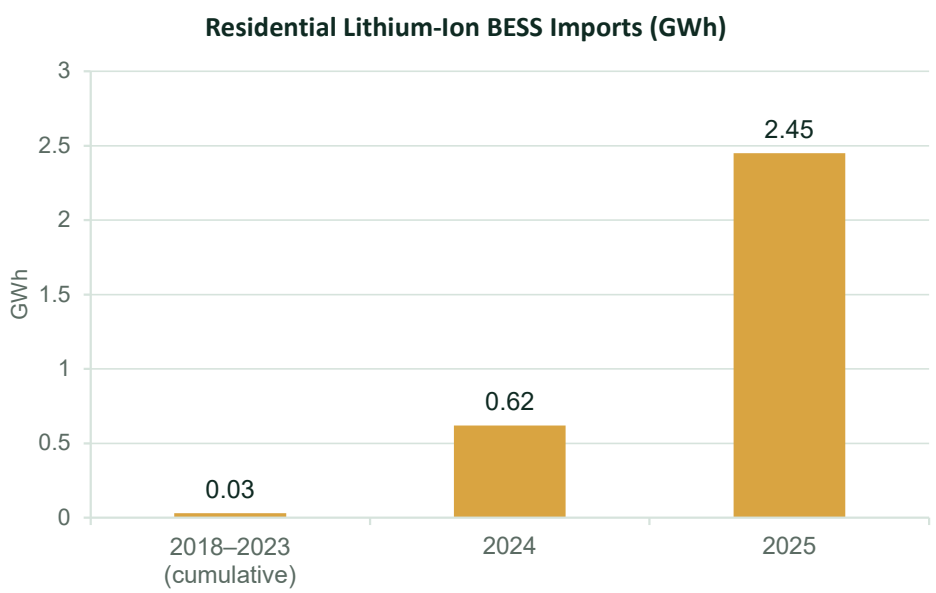
The clearest real-world evidence yet that distributed solar can cushion Pakistan's grid against external fuel shocks — and, as the next slide shows, why storage (BESS) is the logical next step to extend that resilience into the night.

Sources: The Express Tribune, Pakistan Today, Al Jazeera (April 2026 reporting); Power Division / NEPRA statements (user-corrected peak demand figure)

LOOKING AHEAD

What's Next? Net Billing Is Fuelling a Battery Rush

With exports now credited at a lower reference rate instead of the full retail tariff, storing surplus solar for evening self-consumption is worth more than sending it to the grid — pushing new installations toward hybrid solar-plus-storage systems and accelerating residential Battery Energy Storage System (BESS) adoption.



Reference period: 2018–2025. The 2018–2023 bar reflects six years combined — residential BESS barely registered as a market until 2024.

Source: "From Solar Panels to Storage: Pakistan's Battery Momentum Is Building," Rabia Babar / Renewables First; Chinese customs import data & Renewables First's calculations.

3.1 GWh — cumulative residential lithium-ion BESS imports by end-2025

+296% — year-on-year growth in residential BESS imports, 2024 → 2025

~282,000 — households estimated to be equipped with battery storage by 2025

Still early days

Despite the acceleration, only about 1 in 26 solarized households (~4%) currently has battery storage — pointing to significant untapped potential as net billing economics push further toward self-consumption.

BALANCING INTERESTS

Where Stakeholders Agree — and Where They Don't

Regulator / DISCOs

- Grid sustainability requires cost-reflective pricing for exported power
- Fixed network costs must be recovered from a shrinking non-solar base
- Periodic rate review needed as technology and adoption evolve

Prosumers / Solar Industry

- Sharp buy-back cuts undercut payback economics for recent adopters
- Middle-income households, not only the wealthy, have adopted solar
- Contract sanctity for existing 2015-era agreements is essential

Independent Analysts

- Structural issues — losses, capacity payments — predate net metering
- Better data on off-grid/behind-the-meter solar is still needed
- A phased, transparent transition reduces investment uncertainty

GLOBAL CONTEXT

Pakistan Is Not Alone in Rethinking Net Metering

California, USA

NEM 3.0 (2023) replaced 1:1 retail crediting with an avoided-cost export rate roughly 75% lower, following explosive rooftop growth and cost-shift concerns — the closest global parallel to Pakistan's shift.

Spain

Long relied on self-consumption compensation rather than full net metering; surplus is compensated at wholesale-linked rates, not the retail tariff.

India

Several states have moved from net metering toward gross metering / net billing for larger rooftop systems as distributed capacity scaled up.

Common pattern

Jurisdictions with fast, unmanaged rooftop growth tend to converge on the same fix: move export compensation from retail parity toward a cost-reflective rate, while grandfathering existing contracts.

WAY FORWARD

Potential Solutions & Reforms Already Underway

A smarter grid needs both a global toolkit of technical and regulatory fixes, and concrete reforms already in motion in Pakistan.

POTENTIAL SOLUTIONS

1. **Improved oversight & enforcement**
   Routine capacity verification tied to export meter data
2. **Smart meters (AMI)**
   Granular, real-time consumption and export visibility
3. **Transformer & feeder monitoring**
   Real-time thermal loading, early-warning for breaches
4. **DERMS**
   Active visibility and control of distributed solar & storage at scale
5. **SCADA modernization**
   Real-time grid observability and automated response
6. **Virtual Power Plants (VPPs)**
   Aggregating rooftop solar + batteries into dispatchable capacity
7. **Battery storage (BESS)**
   Smoothing the duck curve, enabling self-consumption
8. **Updated grid codes & tariffs**
   Mandatory smart-inverter standards, time-of-use pricing

REFORMS PAKISTAN IS ALREADY TAKING

1. **Smart Metering Programme**
   AMI rollout across DISCOs, replacing legacy meters with two-way smart infrastructure
2. **Transformer Monitoring Programme**
   Real-time telemetry at distribution transformers to flag loading and thermal risk early
3. **Grid data centers & analytics platforms**
   Centralized data management enabling informed planning, dispatch, and enforcement
4. **BESS Regulations -Distribution & Transmission Level**
   BESS Committee and two working groups under the main committee
5. **Better regulations**
   Prosumer Regulations 2026 — revised sizing caps and buy-back rates aligned to system cost

SUMMARY

Key Takeaways

- Pakistan's net-metering capacity grew from 190 MW in FY20 to 5,904 MW in FY25 — roughly 31x in five fiscal years — and reached 6,978 MW combined with net billing by mid-2026, among the fastest distributed-solar build-outs recorded anywhere.
- The surge was driven less by policy design than by macroeconomics: a ~75% PKR depreciation, ~140% tariff increases, and a ~60% fall in solar panel import prices between FY21 and FY25.
- Rapid uptake under 1:1 retail crediting created a genuine and measurable fiscal question — an estimated Rs 101 bn revenue effect in FY2024 alone — that policymakers are now addressing through net billing.
- The move to net billing (Prosumer Regulations 2026, notified 8 Feb 2026) mirrors transitions already made in markets like California, trading faster payback for prosumers against grid cost-recovery for utilities.
- The core policy challenge going forward is balancing three legitimate interests: rewarding early, rules-compliant adopters; keeping solar economics viable for future ones; and protecting non-solar consumers from cost-shifting.

Thank You

Net Metering in Pakistan — Growth, Regime Evolution, and the Shift to Net Billing

Questions & discussion welcome