Energy Demand & Supply Trends

GILGIT-BALTISTAN, PAKISTAN

An Industry Analysis for Strategic Planning

February 2026

PRAXSY ASSOCIATES

EXECUTIVE SUMMARY

A Hydro-Dominant System Under Chronic Winter Stress

Six findings define the Gilgit-Baltistan energy situation as of 2026

⚡ 211 MW Installed — 86 MW Winter Usable

Nameplate capacity far overstates winter availability. Run-of-river hydro collapses to ~86 MW in winter against latent demand exceeding 500 MW.

❄ 20–22 Hours of Daily Winter Outages

Hard winter conditions in Jan 2025 and Feb 2026 triggered near-total blackouts in parts of GB, particularly Aliabad and Gilgit city.

🔌 No National Grid Connection

GB operates as an isolated system spanning 14,889 km of lines. A Regional Grid Phase I project is underway to first interconnect GB's own stations.

☀ Solar Transition Underway — Not Yet Operational at Scale

100 MW solarisation programme issued tenders; 18.15 MWdc rooftop PV + 11.1 MWh BESS covers public buildings. 58 MW free-panel scheme launched May 2026.

💧 Community Micro-Hydel Is the Proven Decentralised Model

AKRSP-linked portfolio of 169 projects, 18.6 MW, serves 250,000+ people. New Energy Plus programme adding 1.8 MW through 2028.

📋 Policy Must Target Winter Evening Capacity, Not Just Installed MW

The binding constraint is the winter evening peak when hydel is weakest and solar has faded. Storage, balancing grid and loss reduction are priority levers.

SYSTEM BASELINE

An Isolated Hydro-Dominant Grid: 211 MW Installed, Highly Seasonal

Water & Power Department GB (WPDGB) operates outside the national grid — hydel provides >90% of energy

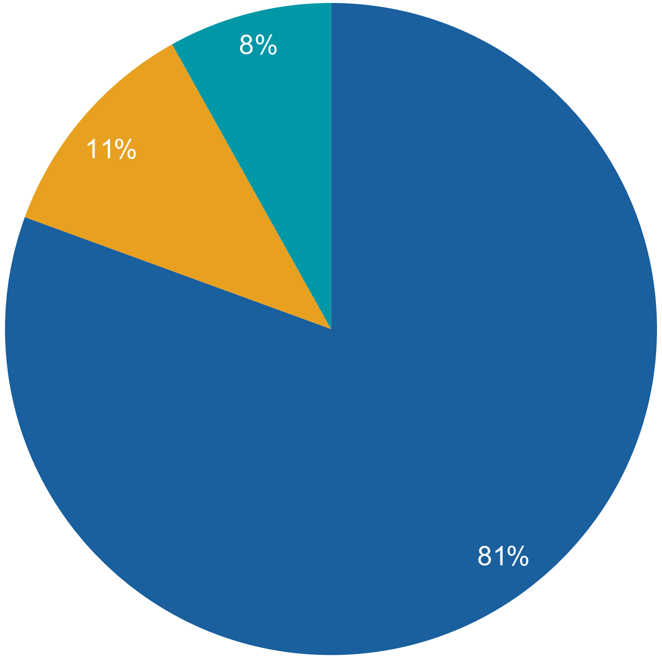
211 MW
Total Installed Capacity
~185 MW hydel + 26 MW thermal

14,889 km
Transmission & Distribution Lines
2,884 transformers across the network

>90%
Share of Hydel in Energy Mix
Thermal/diesel serves as constrained back-up

169
Community Micro-Hydel Projects
18.6 MW | 250,000+ beneficiaries (AKRSP)

Installed Capacity Mix (MW)



Key System Characteristics

Isolated grid:

No import from national system. A regional grid Phase I is underway to interconnect GB's own stations first.

Seasonal derating:

Summer generating capability: 113.65 MW. Winter: only 86.12 MW — a 24% seasonal drop from an already-constrained base.

Suppressed demand:

Latent demand estimated above 500 MW vs. ~150 MW currently served. The gap is hidden by rationing, not met by supply.

Network fragmentation:

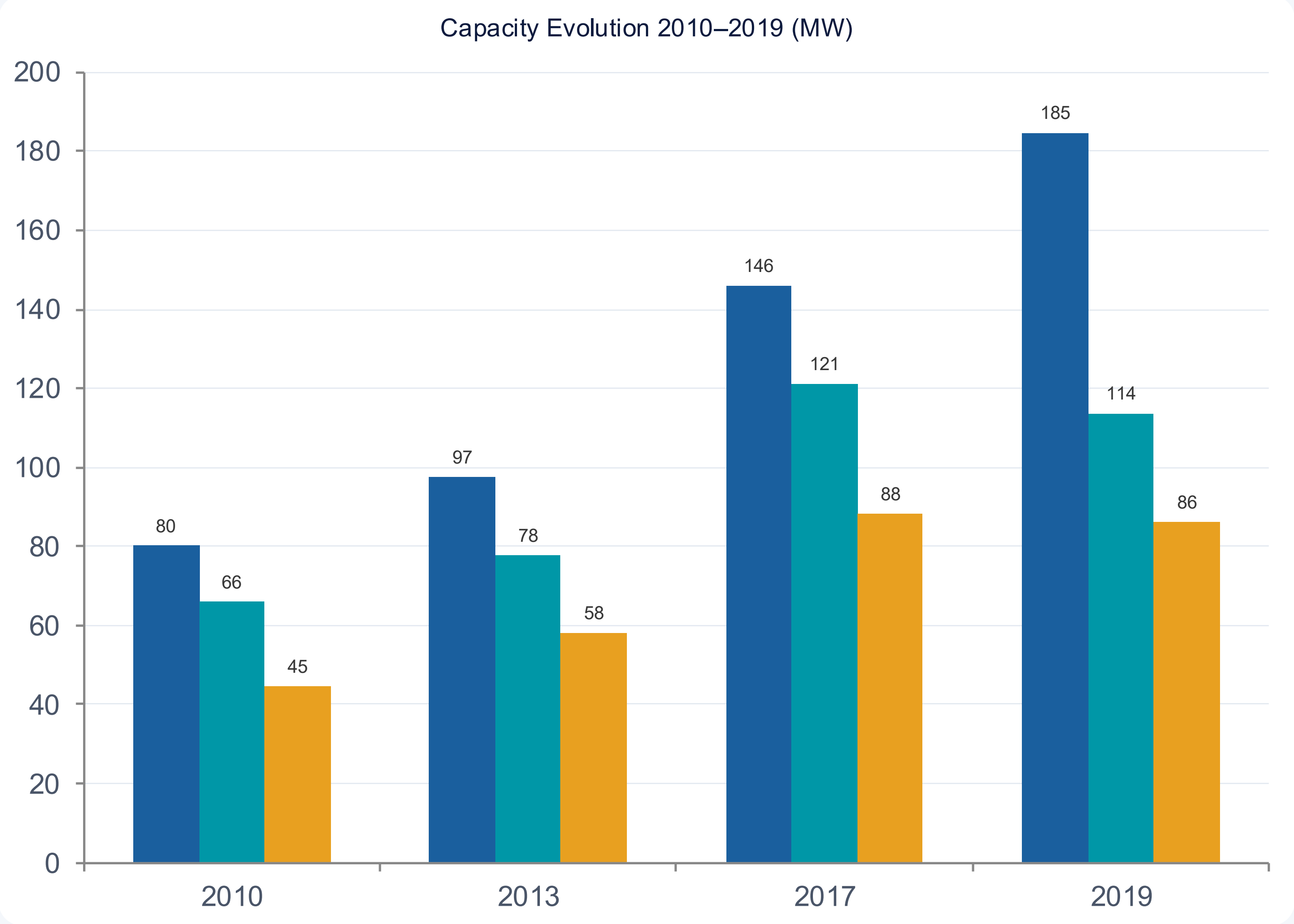
Valley-by-valley systems mean one area's surplus cannot relieve another's deficit. Dispatch flexibility is near-zero.

~40% energy losses:

Historical planning data cite technical + commercial losses around 40%, compounding physical shortage with revenue leakage.

Nameplate Numbers Obscure the Real Winter Gap

Installed capacity grew 2.3× from 2010–2019, yet winter dependable capacity still covers only ~17% of latent demand



184.55 MW

Installed (2019)

Nameplate figure cited in official reports

113.65 MW

Summer Capability

Actual summer generated output, 2019

86.12 MW

Winter Capability

Drops 24% below summer — when demand peaks

>500 MW

Latent Demand (2023)

GB Climate Strategy — suppressed by rationing

RELIABILITY CRISIS

20–22 Hours of Daily Outages: A Structural Winter Failure

The crisis is not a temporary fault — it is the predictable outcome of hydrology, network fragmentation, and suppressed investment

22

HOURS

of daily outages
reported Jan 2025
& Feb 2026

Sources: Dawn (2025, 2026), AP reporting, Aliabad district data

01

Hydrological Seasonality

Run-of-river hydro output collapses in winter as snowmelt and streamflows fall sharply — exactly when heating demand peaks.

02

Network Fragmentation

Valley-by-valley grid isolation means local deficits cannot be balanced across the territory. No inter-valley dispatch.

03

Climate Physical Risk

Flash floods and landslides repeatedly damage generation assets, roads, and distribution infrastructure.

04

~40% System Losses

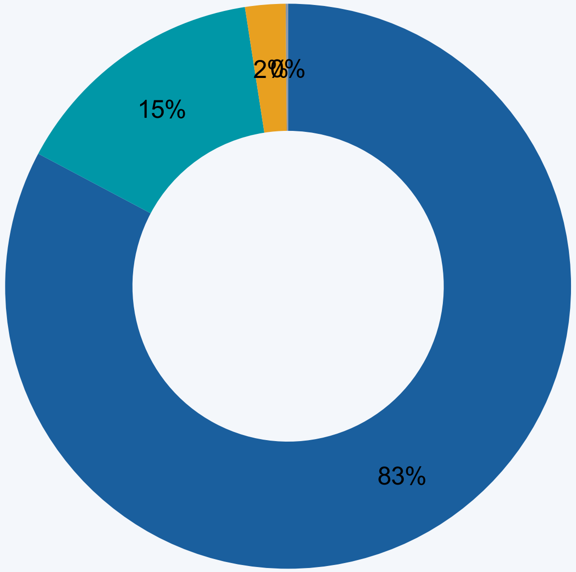
High technical and commercial losses — reported in historical WB and planning data — erode both physical supply and utility revenue.

DEMAND ANALYSIS

197,256 Registered Consumers — Overwhelmingly Residential

2019 official data: households dominate, but commercial and tourism growth is accelerating future demand

Consumer Segment Breakdown (2019)



Households — **82.8%**

Strongest winter & evening peak. Highest exposure to rationing. Depend on subsidised lifeline tariff (Rs 3.95/kWh up to 50 units).

Tourism & Commerce — **14.8%**

Hotels and guest houses face dual peaks — summer tourist season + year-round evening loads. Reliability as critical as tariff.

Agriculture & Cold-Chain — **Growth**

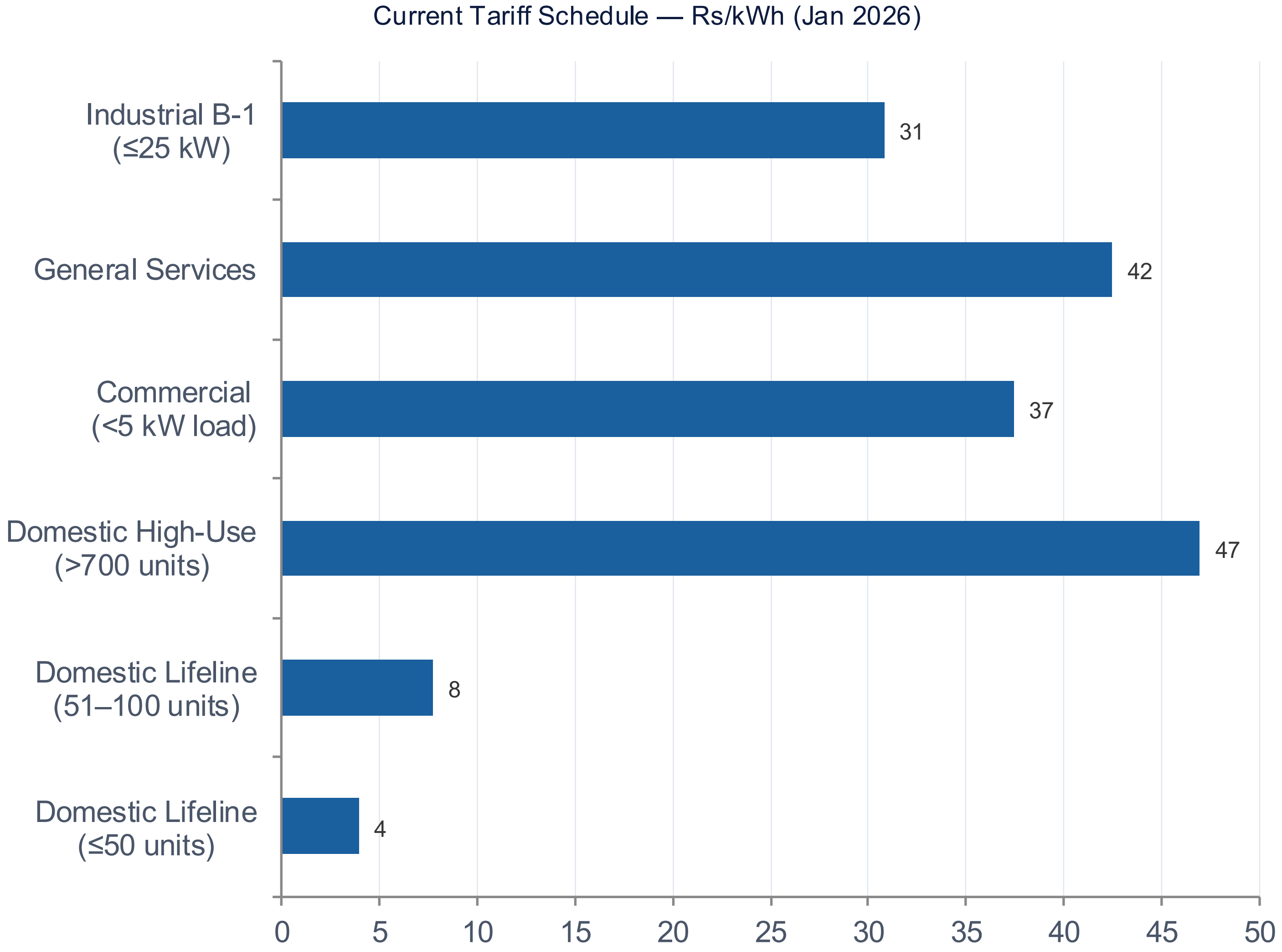
Currently underserved. Lack of cold-chain storage for fruit and perishables is a documented gap and major future load driver.

Public Institutions — **Priority**

Schools, clinics, offices — first targets for rooftop solar-plus-storage under the 18.15 MWdc public building programme.

Nationally Uniform Tariffs Mask a Structurally Subsidised System

NEPRA Jan 2026 uniform tariff — backed by Rs 248 billion federal subsidy — protects low-use households but penalises scale-up



Affordability Analysis

Subsidy architecture

Rs 248 bn federal subsidy underpins the XWDISCO tariff for CY2026. GB's supply costs are structurally high; uniform tariffs hide the true gap.

Lifeline protection works

At Rs 3.95–7.74/kWh for low-use households, protected slabs are affordable in a cold, low-income mountain context.

Beyond protected slabs

Commercial and high-use rates (Rs 37–47/kWh) create strong incentives for self-generation and under-investment in grid-connected loads.

Seasonal income mismatch

Rural payment ability is post-harvest and irregular. Prepayment and concessional financing suit GB better than flat monthly billing.

Utility financial gap

Without transparent WPDGB accounts, the O&M funding shortfall is unquantified — but historical WB work flagged low recovery as structural.

DECENTRALISED MARKET

Decentralised Energy Is Core Infrastructure — Not a Welfare Add-On

Three proven technology tracks, each with distinct economics, O&M models, and scaling constraints

MATURE

💧 Community Micro-Hydel

- 169 projects | 18.6 MW
- 250,000+ people served
- PKR 3–5/unit tariff

GB's most proven model. AKRSP-led implementation in remote valleys. New Energy Plus programme (2023–28) adds 1.8 MW. Best in perennial-flow sites; vulnerable to flood damage and winter flow collapse.

Key risk: O&M reserves & standardisation

SCALING

☀ Rooftop Solar + BESS

- 18.15 MWdc | 11.1 MWh BESS
- Public buildings across 10 districts
- 58 MW free-panel scheme live

First tendered tranche covers public institutions. Free-panel scheme received 50,000+ applications, 15,000 selected. Daytime only without storage; strongest value at schools, clinics, and water schemes.

Key risk: Battery replacement cycles & financing

EMERGING

🔋 Hybrid Hydro-Wind-Battery

- US$0.047–0.097/kWh modelled CoE
- 14-site GB feasibility study
- Matches GB resource profile

Academic modelling shows strong fit for remote GB villages combining run-of-river, wind, and battery storage. Attractive levelised cost where sites are isolated. Requires planned O&M reserves and periodic battery replacement.

Key risk: Implementation capacity & bankability

LEGACY

⚠ Diesel / Thermal Back-up

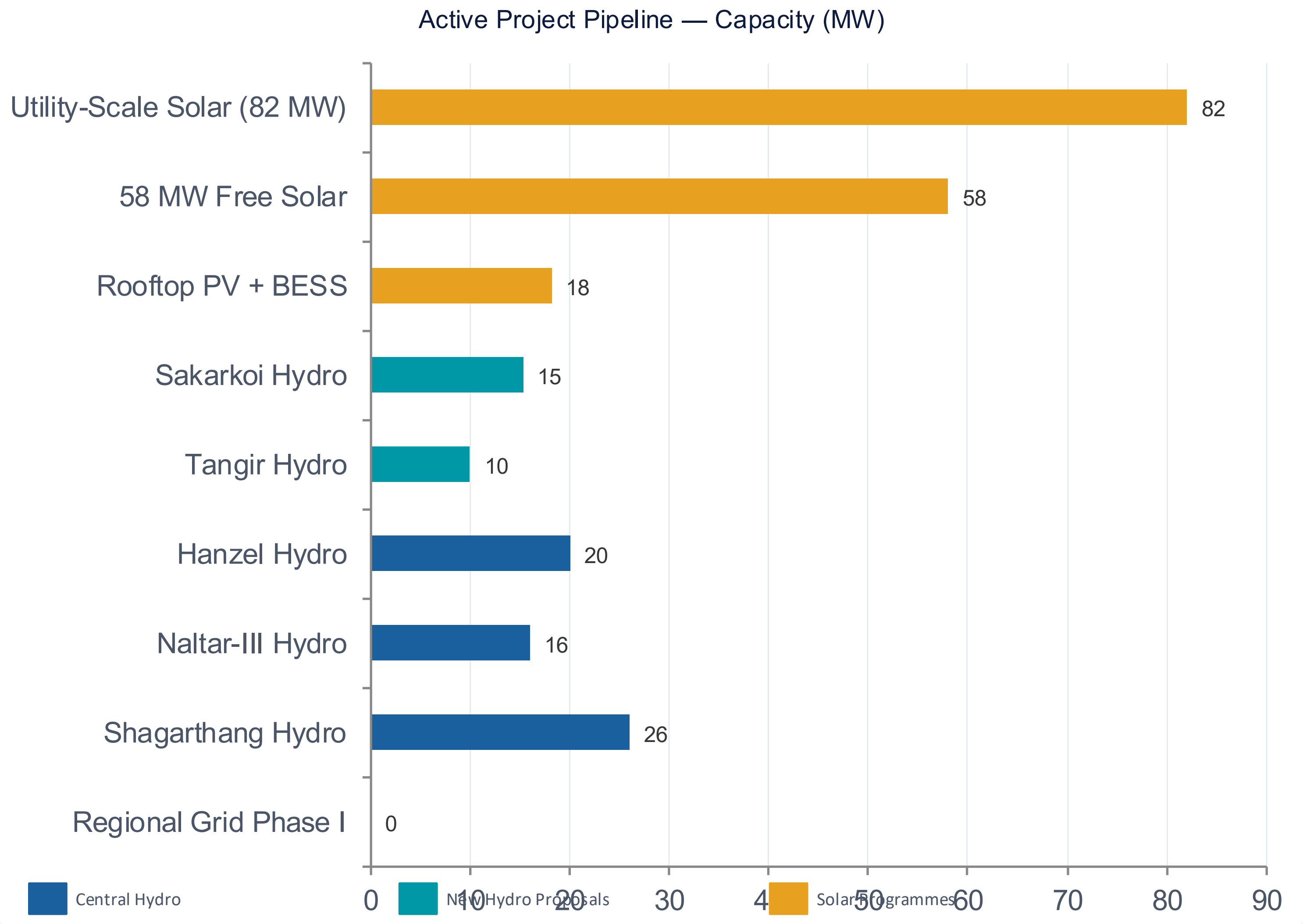
- ~26 MW in public fleet
- Costly & environmentally poor
- Emergency contingency only

Present in the WPDGB fleet as emergency cover. Official documents frame these as unsustainable relative to solarisation. Not a durable answer to structural winter shortage.

Key risk: Fuel cost, emissions & lock-in

Substantial Pipeline — But Schedule Slippage Is Already Visible

PSDP 2025-26 and GB planning documents show multiple active projects; 100 MW solar target moved from Jun 2026 → mid-2027



Execution Risks

Schedule slippage

100 MW solar target already slipped from Jun 2026 → mid-2027 per May 2026 APP report. Treat announced MW ≠ deliverable MW.

Network fragmentation

Regional grid itself was justified because GB's stations are not yet effectively interconnected — a baseline deficit.

Climate physical risk

Floods damage micro-hydels, roads, and lines. Pipeline projects in flood-exposed valleys carry unquantified reinstatement costs.

Standards deficit

Off-grid guidebook warns: lack of standardisation in mini/micro-hydel leads to sub-par equipment and quality failures.

Financing gap

SBP RE scheme (Rs 53 bn to 717 projects nationally) is currently inactive with little clarity on future availability.

OUTLOOK

Three Scenarios for 2029–2031: Diverging Outcomes Based on Execution

Demand modelled at ~3.19% CAGR (LEAP-based academic study). Conservative floor: ~550 MW by 2029, ~585 MW by 2031

Delayed Build-Out

High Risk

What gets delivered:

Naltar-III + small ADP hydro + partial solar or grid programme only

By 2029

Marginal service improvement. Winter outages remain 15–20 hrs daily, especially evening peaks.

By 2031

Headline installed capacity rises on paper. Winter dependable capacity still covers <20% of latent demand.

On-Schedule Official Pipeline

Base Case

What gets delivered:

Naltar-III, Shagarthang, key grid works, most of 100 MW solarisation completed

By 2029

Daytime winter shortage narrows materially. Public institutions and some feeders become more resilient.

By 2031

GB moves from crisis management to managed scarcity. Evening winter deficits persist without larger storage.

Distributed Resilience Pathway

Best Case

What gets delivered:

Base case + 58 MW customer solar, public-building batteries, micro-hydel rehab, feeder + loss reduction

By 2029

Fastest visible improvement: households, clinics, schools, water schemes, and tourism nodes all benefit.

By 2031

Best chance of cutting outage hours and diesel dependency even if central winter peak gap is not fully eliminated.

POLICY IMPLICATIONS

Seven Priority Actions to Unlock Reliable Power in GB

Ranked by speed-to-impact. Central-grid-only strategy will not eliminate winter scarcity fast enough.

1 Reframe planning metric: winter evening dependable capacity

Replace installed MW as the headline metric. The binding constraint is the winter evening peak when hydel is weakest and solar has faded.

2 Fast-complete near-finished hydro (Naltar-III, Shagarthang)

Completing near-ready projects unlocks more reliability sooner than distant megaproject promises.

3 Commission Regional Grid Phase I

Interconnecting GB's own stations is the prerequisite for any later national grid link— and it immediately improves dispatch flexibility.

4 Accelerate solar-plus-storage for public buildings

18.15 MWdc + 11.1 MWh BESS across 10 districts. Clinics and schools need resilience more than cheap tariffs.

5 Rehabilitate flood-damaged micro-hydel and feeder infrastructure

Physical reinstatement is faster and cheaper than new build. AKRSP's Energy Plus programme sets the model.

6 Tighten metering, billing, and loss control

~40% system losses destroy the supply-demand balance. Every MW saved through loss reduction has the same effect as a new MW built.

7 Commission a territory-wide load survey and dependable-capacity assessment

No bankable investment plan is possible without current hourly load data, feeder-level accounting, and seasonal capability by hour.

Conclusions

GB's energy crisis is structural, not cyclical. An isolated, hydro-dominant grid serving >500 MW of suppressed demand with ~86 MW of winter dependable capacity cannot be fixed by announcements alone.

The hybrid pathway is the only viable route. Central hydro and a balancing grid for bulk service, plus distributed solar-storage and micro-hydel for remote valleys, public services, tourism, and agriculture.

Execution speed matters more than project size. Completing near-finished hydro, commissioning the regional grid, and rolling out public-building solar-plus-storage will deliver faster relief than distant megaproject timelines.

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