India Solar+BESS Block Sizing 2026: DC Coupling, PCS, HT and EPC Risk Guide

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A 2026 India guide to solar+BESS block sizing: DC coupling, PCS loading, HT design, ALMM/CFA impacts, EPC risks and lender checks.

Hybrid solar-plus-storage projects in India are moving from pilot discussions to mainstream procurement, but one design choice still decides a large share of project economics and execution risk: block sizing. Get the solar array, inverter loading, battery power-to-energy ratio, power conversion system sizing and HT evacuation philosophy wrong, and the plant will carry avoidable clipping, curtailment, transformer overloading, unusable battery capacity or expensive redesign during commissioning.

For Indian C&I buyers, RE developers, lenders and utilities, 2026 is a year where hybrid sizing has to reflect more than equipment nameplates. It must reflect time-of-day tariffs, open-access banking limits, state scheduling practices, ALMM-linked module procurement constraints, BESS duty cycle, auxiliary consumption, warranty boundaries and the real response expected by DISCOMs and SLDCs.

This guide focuses on a clearly different topic from typical module, inverter or commissioning articles: how to size the solar+BESS block itself, from DC and AC architecture to transformer and feeder decisions, with an EPC and bankability lens.

Why block sizing matters more in 2026

In 2026, hybrid projects are being evaluated on delivered value in specific hours, not just annual generation. A 20 MWp solar plant with a 10 MW/40 MWh battery can outperform or underperform another plant with the same headline numbers depending on whether the system is AC-coupled or DC-coupled, how much PV overbuild is used, whether the PCS is sized for simultaneous charge/discharge support, and how evacuation capacity is reserved.

Three market shifts explain why this matters now:

- Time-of-day and peak-period tariffs are becoming more relevant for C&I procurement, especially where evening demand charges and peak energy charges are high.
- Storage-linked tenders and RTC/FDRE style procurement have made dispatchability and ramp behaviour central to value creation.
- Equipment supply chains remain sensitive to ALMM timing, imported subcomponents, cell/module format changes and BESS integration lead times.

In practical terms, many Indian hybrid plants are now being assessed on metrics such as:

- Rs/kWh delivered during peak windows rather than average annual solar LCOE
- Round-trip operating value after auxiliary loads and conversion losses
- Number of contracted peak-support hours actually available at guaranteed state of charge
- Grid export stability, ramp control and reactive power capability at the interconnection point

That means block sizing is no longer a drafting exercise. It is a commercial decision embedded in engineering.

Start with the commercial use case, not with MW and MWh labels

Before finalising any single-line diagram, define the use case in measurable terms. In India, the same 50 MWp solar plant with 20 MWh storage could be designed three completely different ways depending on the offtake structure.

Typical 2026 use cases include:

- C&I peak shaving: reduce 2 to 4 hour evening drawal from DISCOM supply, especially where peak tariffs can exceed off-peak rates by Rs 1.5 to Rs 3.5 per kWh.
- Open-access firming: smooth contracted schedules and limit imbalance or DSM exposure.
- Renewable energy time-shifting: store midday surplus and deliver into evening demand windows.
- Grid-support or utility dispatch: comply with schedule, ramp-rate and availability commitments.
- Captive resilience: maintain essential loads for defined durations, sometimes with black-start expectations.

For each case, define at least these parameters:

- Contracted export/import limit in MW
- Target discharge window in hours per day
- Required annual cycles, for example 250, 330 or 365 cycles
- Minimum end-of-life usable capacity, often 70% to 80% depending on warranty
- Maximum permissible clipping/curtailment loss
- Required ramp rate and response time

Without this step, engineers often oversize the battery energy for a duty cycle that is actually power-limited, or oversize the PCS while leaving the HT system constrained.

DC-coupled vs AC-coupled: choose based on operating physics, not fashion

The most common architecture question in Indian solar+BESS is whether to adopt DC coupling or AC coupling. There is no universal winner. The right answer depends on clipping recovery potential, dispatch strategy, retrofit constraints and protection philosophy.

DC-coupled systems typically place the battery on the DC side of the solar inverter architecture, often sharing conversion stages or integrating with hybrid inverter/PCS platforms. AC-coupled systems keep the PV inverter output and battery PCS on the AC bus.

DC-coupled advantages:

- Better capture of clipped solar energy when the DC/AC ratio is high and midday clipping is material
- Potentially lower conversion losses for charging from PV compared with PV-to-AC-to-DC pathways
- Reduced AC-side equipment in some configurations
- Attractive where land or interconnection limits make clipped-energy recovery valuable

DC-coupled constraints:

- More complex controls and OEM interoperability considerations
- Tighter dependence on inverter architecture and firmware maturity
- Harder retrofit into existing AC solar plants unless hybrid-ready from the start
- Battery charging can become solar-availability dependent unless designed for grid charging too

AC-coupled advantages:

- Modular design and easier integration with existing or phased solar assets
- Independent operation of PV inverters and battery PCS
- Greater flexibility for grid charging, ancillary support and battery-first operation
- Simpler expansion path if storage augmentation is expected later

AC-coupled constraints:

- Additional conversion steps can increase charging/discharging losses
- More AC switchgear, transformer capacity and protection coordination requirements
- Simultaneous PV export and battery charge/discharge can strain AC buses if not sized carefully

A practical Indian rule of thumb in 2026:

- If the project is a retrofit or requires high operational flexibility under varying schedules, AC coupling is usually easier to execute.
- If the project is greenfield, land/interconnection constrained, and designed around clipping recovery plus limited time shifting, DC coupling can be superior.

But the decision should be justified through an hourly energy model, not a generic efficiency claim.

Sizing the solar array, battery power and battery energy together

Many project teams still size PV first and then “add” BESS. That usually produces a suboptimal plant. Hybrid sizing should be solved jointly.

Start with the PV DC/AC ratio. In India, utility and C&I solar projects commonly use DC/AC ratios around 1.25 to 1.6 depending on irradiation profile, module technology, clipping appetite and land economics. In a hybrid plant, a higher DC/AC ratio can make sense if clipped energy can be stored, but only if battery charging windows, battery C-rate and balance-of-plant can absorb it.

Example:

- PV array: 60 MWp
- Solar inverter AC capacity: 40 MWac
- DC/AC ratio: 1.5
- Battery: 15 MW / 60 MWh

This can work well if:

- Midday clipping exists often enough to justify storage capture
- The battery can charge at 15 MW during high-irradiance windows
- The evacuation system can handle intended simultaneous export and charging logic
- Control systems prioritise economics across seasons, not just summer peaks

Now consider battery power-to-energy ratio. Common Indian project ratios in 2026 include:

- 0.25C: 4-hour system, such as 10 MW/40 MWh
- 0.5C: 2-hour system, such as 10 MW/20 MWh
- 1.0C: 1-hour system, used where short peak support or fast response is needed

For solar time-shifting, 2-hour to 4-hour systems are usually more relevant than 1-hour systems. For demand charge management in C&I, 1-hour to 2-hour systems may be sufficient if demand peaks are sharp and predictable.

Do not ignore usable energy. A 40 MWh nameplate battery does not mean 40 MWh daily dispatchable energy at the meter. Account for:

- Upper and lower SOC buffers
- Auxiliary consumption, including HVAC and controls
- Conversion losses in PCS and transformer
- Degradation over time
- Temperature-related derating

A nominal 40 MWh system may deliver only around 34 to 37 MWh usable at beginning of life depending on design margins and metering boundary. Lenders will ask where exactly guarantees are measured: DC battery terminals, PCS output or point of interconnection.

PCS, inverter and transformer sizing: where many EPC mistakes begin

The power conversion system is often mis-sized because teams focus on battery energy rather than dispatch power, overload capability and simultaneous operating modes.

Key sizing questions include:

- Must the PCS support full contracted discharge while PV is exporting at high output?
- Is grid charging allowed, and if yes at what maximum power?
- What overload is needed for transient response or voltage support?
- Does the battery warranty assume a specific C-rate or ambient condition?

For instance, a 20 MW/40 MWh battery may be paired with 20 MW of PCS, but if the project expects simultaneous 40 MW PV export plus 20 MW battery discharge on a shared transformer path, the transformer and HT feeder may need to support 60 MW plus reactive margin and auxiliary demand. If the evacuation approval is only for 50 MVA, then either export control, curtailment logic or a different architecture is required.

This is where hybrid projects frequently run into late-stage redesign.

Critical EPC checks:

- Inverter and PCS harmonics contribution at partial loading
- Transformer loading under worst-case ambient conditions
- Reactive power capability at the point of interconnection, not just at inverter terminals
- Protection coordination for reverse power, anti-islanding, differential and earth fault schemes
- Metering architecture for separate accounting of solar generation, battery charge source and discharge energy

In practice, a robust design review should model at least these operating states:

- High PV export, no battery activity
- High PV export with simultaneous battery charge
- Moderate PV export with full battery discharge

- No PV, full battery discharge in evening peak
- Grid-charge mode where permitted
- Black-start or island support where relevant

Growthifye teams working on [Solar & hybrid plant EPC](/coreservices/epc/solarandhybridplantepc) and [BESS system integration](/coreservices/epc/besssystemintegration) should be testing these states at design freeze, not after procurement.

HT evacuation, interconnection and protection philosophy for hybrid plants

A hybrid plant is only as good as its interconnection strategy. In India, developers often secure solar evacuation assumptions first and then fit storage around them. That can leave latent constraints that only appear during utility review or commissioning.

HT design questions to resolve early:

- Is the export limit based on MW, MVA or contracted demand assumptions?
- What reactive power band must be maintained at the interconnection point?
- Are there SLDC or DISCOM restrictions on charging from grid?
- Will separate feeders or metering be needed for solar and storage in a CFA-linked or accounting-sensitive setup?
- Does the system need dynamic plant controller functionality for ramp-rate management?

For a C&I project at 33 kV, battery discharge may help reduce drawal during expensive periods, but if the interconnection transformer is already near thermal limits under daytime solar export, evening battery discharge might still be fine while simultaneous charging creates overload risk earlier in the day. A feeder that is adequate for standalone solar may be inadequate for hybrid cycling.

Protection philosophy must also change. Hybrid plants need clear logic for:

- Source-direction sensitivity
- Islanding prevention where behind-the-meter systems can energise local buses
- Synchronisation checks for PCS reconnection
- State-based relay settings if operating modes materially differ

Utilities and lenders increasingly prefer a documented control narrative with cause-and-effect matrices, not just relay lists.

ALMM, CFA schemes, procurement and quality implications

In 2026, hybrid design is tightly linked to procurement reality. PV modules may be subject to ALMM applicability depending on project category and offtake conditions, while storage packages face separate supplier qualification, safety and warranty scrutiny. Hybrid block sizing must therefore reflect what can actually be procured and delivered on time.

Procurement-linked issues that change sizing decisions:

- Module wattage and current characteristics influence string and inverter architecture
- Hybrid inverter or PCS lead times can exceed conventional PV inverter timelines
- Transformer delivery for custom ratings may become a critical path item
- Battery container ratings can vary with site temperature and altitude assumptions

- OEM warranty conditions may limit continuous operation at top C-rate in Indian summer conditions

For projects expecting central or state support, CFA-linked design compliance and documentation should be considered from the start. Scheme conditions can affect eligible capacities, metering boundaries, approved equipment categories and commissioning evidence. If the battery and solar accounting architecture is unclear, subsidy claims or benefit qualification can become difficult even when the plant is technically functional.

This is why [Procurement & vendor management](/coreservices/epc/procurementandvendormanagement) and QA/QC & HSE enforcement are not downstream activities. They shape the design basis itself.

A prudent 2026 EPC strategy includes:

- Freezing OEM responsibility matrices early
- Validating thermal derating assumptions using site weather data
- Aligning guaranteed capacity and efficiency values with the metering point in the PPA or supply agreement
- Reviewing augmentation assumptions if the battery must maintain contracted output in later years
- Confirming spare-parts and service support availability in India

What lenders and serious offtakers now look for

Lenders are no longer satisfied with broad statements like “battery improves dispatchability.” They want to see how the plant behaves hour by hour, season by season, and under equipment degradation.

Expect diligence questions around:

- Hourly dispatch simulation and tariff arbitrage logic
- Degradation model for modules and batteries together
- Round-trip efficiency assumptions at site conditions
- Compliance with Indian interconnection and safety requirements
- Replacement and augmentation capex assumptions over project life
- Guaranteed performance test procedures and liquidated damages triggers

An offtaker or lender will gain confidence if the project file clearly shows:

- Why AC or DC coupling was selected
- Why the PV DC/AC ratio supports the commercial use case
- Why the battery power and energy ratio matches the duty cycle
- Why the transformer and feeder can handle all operating modes without hidden curtailment
- How protections, controls and metering support settlement and compliance

That level of clarity also reduces EPC change orders and post-commissioning disputes.

A practical sizing checklist for Indian solar+BESS projects

Before tender issue or financial close, confirm the following:

- Defined use case with hourly dispatch objective
- Architecture choice supported by simulation: AC-coupled or DC-coupled

- PV overbuild justified against clipping capture and battery charge windows
- Battery C-rate aligned with revenue model and warranty
- PCS sized for real simultaneous operating conditions
- Transformer and HT evacuation sized for worst-case state, not average state
- Grid-charge permissibility and settlement implications documented
- ALMM and equipment eligibility assumptions validated
- Performance guarantees tied to a clear metering boundary
- Commissioning tests cover all intended hybrid modes

The difference between a bankable hybrid project and an expensive design experiment often comes down to this discipline.

India's solar+BESS market in 2026 offers real value, but only to projects whose block sizing matches the commercial objective, grid reality and procurement environment. Headline MW/MWh numbers do not reveal whether a project will deliver peak support, protect margins or survive utility scrutiny. Correct hybrid sizing does.

If you are evaluating a new solar-plus-storage project, a retrofit, or lender diligence on hybrid EPC assumptions, contact Growthifye's advisory desk for project-specific support on design review, procurement strategy, commissioning readiness and risk mitigation.

Explore Growthifye's related capabilities

This analysis connects directly to our advisory practice: [Solar & hybrid plant EPC](/coreservices/epc/solarandhybridplantepc) · [BESS system integration](/coreservices/epc/besssystemintegration) · [Balance of system & civil works](/coreservices/epc/balanceofsystemandcivilworks) · [Procurement & vendor management](/coreservices/epc/procurementandvendormanagement).

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