

Beyond Mobility

Unlocking The
Second-life Battery
Opportunity



POLICY BRIEF

Building India's Market for
Repurposed EV Batteries



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Note:

This report was prepared as part of a study titled 'Mainstreaming and Scale-up of the use of Repurposed EV Battery Solutions for Circularity within the EV Supply Chain'.

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An application-led pathway from pilots to a credible market

The policy proposition: This paper proposes that India need not subsidise repurposed batteries across all applications. Rather, public support could be limited to applications where a verified battery can deliver a reliable service at a competitive lifecycle cost and where the market cannot yet finance the investment without temporary support, building on the evidence already generated by pilots across India. Existing government programmes could provide the first demand, under common rules for safety, performance, monitoring, and final recycling.

Executive summary

India's transition to electric mobility will eventually create a large number of batteries that no longer meet the demanding requirements of vehicles. Some of these batteries may still have sufficient capacity to support less demanding stationary applications, such as household backup, rural enterprises, public facilities, commercial backup and distribution-system services. TERI estimates that India's cumulative battery-repurposing potential could reach approximately 0.9-1.4 TWh by 2050. (TERI, Beyond Mobility: Unlocking the Second-Life Battery Opportunity, Vols I-III, 2026).

Illustrative pilots

- A 100-kWh solar-integrated EV-charging station near Kempegowda International Airport.
- A 224-kWh solar-based electric-bus depot in Surat.
- An off-grid solar EV-charging installation at IIT Delhi, presented as scalable from 20 kWh to 100 kWh.
- Small solar-plus-storage systems at schools, livelihood facilities and a farmer training centre in Uttarakhand.
- Institutional and livelihood applications involving healthcare equipment, millet processing and a roadside motor workshop.

This opportunity should not, however, be interpreted as evidence that every retired EV battery can be reused or that repurposed batteries are automatically cheaper than new ones. Retired batteries differ in chemistry, age, operating history, condition and remaining life, and their reuse requires collection, testing, reconfiguration, control systems, power electronics, certification, warranties, and eventual recycling. With the right supporting measures, such as aggregation and regional testing and refurbishing hubs, these additional costs and risks can be reduced, helping to preserve the price advantage of repurposed batteries over new ones.

Multiple demonstrations across India showcase that repurposed batteries can be integrated and configured for rooftop solar, public facilities, livelihood equipment, commercial backup, diesel displacement and EV-charging infrastructure. However, comparable evidence on cost, degradation, reliability, and long-term performance remains limited. The immediate policy priority should, therefore, be to build operating evidence and market confidence before retired EV batteries become available at scale.

This paper recommends an **application-led market-development programme**, rather than a general subsidy for repurposed batteries. It identifies six priority applications grouped under four deployment areas:

1. Residential rooftop solar-plus-storage
2. Productive rural energy and essential public services
3. Industrial and Commercial
 - a. Industrial diesel displacement
 - b. Telecom backup
 - c. Charging-station and bus-depot peak shifting
4. Fixed or relocatable storage for DISCOMs

Public incentive support should vary according to the application. Higher support may be justified for essential public services and rural livelihoods, where users have limited ability to pay and some benefits cannot be monetised. Commercial users should finance most of their projects because they directly capture savings from lower diesel consumption, reduced peak demand and improved reliability.

The paper proposes application-specific central-support ceilings generally ranging from 10% to 40% of eligible costs. Total public capital support should not exceed 50% in the residential illustration, including any state or DISCOM contribution; these proposed levels should be treated as maximum pilot ceilings, not standard

entitlements. Actual assistance is best limited to the minimum amount required to make a project viable and would ideally be determined through competitive procurement. Part of the assistance should be released only after the system demonstrates the promised service.

India does not need a separate subsidy scheme for each application. Existing initiatives, including PM Surya Ghar for rooftop solar, PM-KUSUM feeder solarisation, decentralised renewable energy, public charging programmes such as PM E-DRIVE, and power-sector storage frameworks, can anchor initial demand. These

programmes should be combined with common requirements for battery traceability, independent health assessment, complete-system certification, warranties, remote monitoring, take-back and authorised recycling.

The paper proposes a three-year, 100-150 MWh market-development programme. Its success should be measured not by the number of batteries deployed, but by whether it produces reliable operating data, standard contracts, lower risk premiums, stronger warranties, the infrastructure needed to support scale-up, and declining subsidy requirements.

1. The opportunity is real, but it is not uniform

Retired EV batteries should be treated as conditional energy assets, not as low-cost substitutes for new batteries in every application.

A battery generally leaves vehicle service because it can no longer deliver the range, power or reliability expected in an EV. That does not mean that it has no remaining value. A battery with verified condition and predictable degradation may continue to serve a less demanding stationary load for several years. Repurposing can, therefore, extend the productive use of an asset before it enters authorised recycling.

Yet “second life” is not a single product category. Retired packs vary by chemistry, voltage, age, thermal history, usage pattern and remaining useful life. The cost advantage of the used cells can be eroded by collection, transport, diagnostics, reconfiguration, BMS replacement, power electronics, certification, warranty, and insurance. Stakeholders consulted by TERI expected repurposed systems to need a 30% - 50% price advantage relative to new battery systems, both to compensate for these uncertainties and to make large-scale adoption commercially viable for large scale adoption.

A decision rule for public support

Public support is justified only when three conditions are met together.

- First, the battery and the complete storage system must be demonstrably safe, technically reliable, and suitable for the intended application. Public resources should not be used to compensate for unresolved safety, performance, or quality risks.
- Second, the project must deliver measurable economic or public value. This may include improving energy reliability for critical facilities, reducing diesel consumption, lowering power procurement costs, supporting renewable-energy integration, or deferring network investments.
- Third, support should address a clearly identifiable market failure during the early market-development phase. Where private investors and users can fully capture project benefits and finance deployment on commercial terms, public intervention is unlikely to be justified.

The policy should begin with applications that tolerate moderate duty cycles and offer a clear, verifiable service. High-stress applications should follow only after operating evidence and standards mature.

Question	Policy Test
Is the battery suitable for the intended application?	• Traceable battery provenance and ownership history • Independent assessment of State of Health (SoH) and Remaining Useful Life (RUL) • No unresolved safety or thermal-management concerns • Demonstrated compatibility between battery characteristics & application requirements
Is public support genuinely additional?	• The project addresses a verified affordability, financing, or service-delivery gap • Support enables outcomes that would not occur under business-as-usual conditions • The project creates public benefits that cannot be fully monetised by the end user
Is the system accountable throughout its life cycle?	• Certified system integration and installation • Defined performance guarantees, warranties, or risk-sharing arrangements • Remote monitoring and data reporting mechanisms • Mandatory take-back arrangements and authorised end-of-life recycling
Can support be reduced and eventually withdrawn?	• Competitive and technology-neutral procurement mechanisms • Transparent disclosure of performance and cost data • Periodic review of support requirements • Pre-defined sunset provisions linked to market maturity and cost reductions

2. What does the evidence from Indian pilots tell us

Pilots across India point towards practical early markets, while also indicating where caution is needed.

The evidence reviewed for this paper covers twelve Indian case studies, including small residential systems, solar-linked public facilities, livelihood equipment, commercial backup, diesel-generator replacement and EV-charging infrastructure. The assessment draws on TERI's India SLB Case Studies database and Beyond Mobility, Volumes I-III (2026). System sizes range from approximately 2-5 kWh for household and institutional applications to approximately 500 kWh for an industrial DG-replacement installation. Charging-related demonstrations include a 100-kWh airport installation, a 224-kWh solar-linked bus-depot system and an off-grid charging system designed to scale from 20 kWh to 100 kWh.

These demonstrations establish that repurposed batteries can be configured to serve different types and scales of stationary demand. However, they do not yet establish that every application is commercially viable or ready for widespread replication. The most credible applications share three characteristics:

- The load and required duty cycle are reasonably predictable.
- The economic or public-service benefit can be measured.
- The verified condition of the battery, including its chemistry, is suitable for the service expected from it; lithium-iron-phosphate (LFP) chemistry predominates in these applications and its reliability is comparatively well understood.

Pilot system size and configuration	What it implies for policy
1-10 kWh rooftop-solar systems	Residential systems may be suitable for standardised product configurations, provided that compatible hybrid inverters, consumer protection, performance warranties and portfolio-level monitoring are in place.
5-18 kWh schools, PHCs and livelihood systems	These applications may create substantial public or livelihood value where reliable electricity is more important than intensive cycling. Clustered procurement and common O&M arrangements can improve service quality and reduce maintenance costs.
100-500 kWh C&I and DG-displacement systems	Measurable savings from diesel displacement or backup-power provision may support commercial financing. Initial public intervention, where necessary, should address performance uncertainty, access to finance and the absence of operating data rather than subsidising the full asset cost.
100-224 kWh charging and depot projects	Storage can be valuable where it absorbs solar generation, reduces peak demand, avoids diesel use or limits connection and network costs. Support could depend on a project-specific assessment of these benefits.
BMS and inverter integration challenges	Qualification should apply to the complete integrated system, including controls and power electronics, rather than to the retired battery module alone. Operators should also be required to share anonymised performance and failure data with the qualifying authority, since this data-sharing is itself an important policy lever for building the evidence base described in this paper.

The pilots also reveal recurring system-integration challenges, including inverter compatibility, voltage spikes and the unavailability of OEM communication protocols. These issues affect system performance, safety, and cost. They can, therefore, determine whether the initial saving from using retired batteries translates into a genuine cost advantage at the complete-system level.

From evidence to priority applications

The evidence supports an **application-led approach**: repurposed batteries should not be deployed simply because retired batteries are available. They should

be considered where a defined energy service can be delivered safely, reliably and at a competitive whole-system cost.

The following chapter, therefore, assesses priority applications in sequence, beginning with household, community and public-service uses, followed by commercial applications and distribution-system flexibility. This progression reflects increasing requirements for system integration, contractual accountability, performance assurance and operational coordination.

3. Priority Deployment Pathways

First pathway: residential solar-plus-storage under PM Surya Ghar 2.0

Residential solar-plus-storage offers a suitable pathway for a national demonstration programme, provided deployment is targeted to feeders where storage can create measurable value for both households and DISCOMs.

Rooftop solar creates an intuitive use case for small-scale storage. Surplus solar electricity generated during the day can be stored for use during evening hours, while the same system can provide limited backup during outages. For households, the principal benefits are higher self-consumption of rooftop solar and improved reliability.

These household benefits do not, however, automatically translate into benefits for the distribution system. A battery creates value for the DISCOM only if its charging and discharging respond to a defined system need, such as absorbing material daytime exports, reducing a coincident evening peak, improving local voltage conditions, or providing dispatchable flexibility.

Residential storage should, therefore, not be supported as an open-ended default benefit available to every rooftop-solar consumer. It should initially be demonstrated on selected feeders where the system needs, expected benefits and battery operating strategy can be clearly established.

Illustrative Design for a Successor Rooftop-Solar Programme

- Adopt a 3-kW rooftop-PV system paired with a 3-kWh battery as the reference configuration, while

permitting storage capacities of 2-5 kWh based on measured household demand, surplus solar generation and the intended service.

- Provide central assistance equal to 40% of the competitively discovered cost of the eligible battery and hybrid inverter, subject to a ceiling of INR 10,000 per kWh and INR 30,000 per household. Any existing assistance for the rooftop-PV system should remain separate.
- Require the consumer to contribute at least 50% of the eligible storage-system cost. Combined central, state and DISCOM capital assistance should not exceed 50%, ensuring that the household retains a meaningful financial stake in the system.
- Preserve the consumer's primary right to use the stored energy. Where the DISCOM reserves, controls, or dispatches part of the battery's flexibility, it should compensate the consumer through a transparent annual availability payment, event-based payment, or benefit-sharing arrangement.
- Require a minimum five-year warranty or an equivalent energy-throughput guarantee, remote performance monitoring, applicable electrical and fire-safety protection, defined vendor O&M obligations and mandatory take-back for authorised recycling.
- Procure and monitor systems at the portfolio level rather than supporting isolated installations. This would enable common technical specifications, lower transaction costs and consistent assessment of performance.

Illustrative household case: For a 3-kWh battery and hybrid inverter costing INR 75,000, central assistance would be capped at INR 30,000. The household would contribute INR 45,000 in the absence of additional support. Where the installation creates a measurable distribution-system benefit, a state or DISCOM contribution of up to INR 7,500 could reduce the household contribution to INR 37,500, while keeping total public capital support within 50% of the eligible cost.

If the DISCOM subsequently reserves or dispatches the battery, the household should receive a separate performance-linked service payment. TERI's analysis indicates that sharing 50% of the estimated DISCOM benefit could reduce payback from ~6 to 5 years in Assam and Bihar.

Why targeting matters

A household battery on a feeder with little daytime export or no evening peak may still provide backup, but it offers limited system value. Pilot feeders should, therefore, be selected using at least 12 months of interval data, rooftop capacity, daytime reverse flow or export, evening peak coincidence and consumer density. This also creates a credible basis for comparing consumer benefit with DISCOM benefit.

Second pathway: productive rural energy and essential public services

The relevant agricultural pathway is not a battery for every solar pump, but shared storage at selected feeders solarised under PM-KUSUM Component C.

Using PM-KUSUM selectively

Feeder-Level Solarisation under Component C provides a suitable institutional entry point because solar generation is connected at the feeder or substation level and implemented through the DISCOM. This assessment should be read alongside the ongoing review and revision of PM-KUSUM, and cost-support parameters for any storage component should be finalised accordingly. Pending completion of the ongoing review of PM-KUSUM, an indicative pilot ceiling of up to 30% may be used for

appraisal purposes, but the final form and level of support should be aligned with the revised scheme framework and determined through competitive procurement. A second-life battery can be located at the same level to absorb solar generation that exceeds feeder demand and discharge it later against aggregate feeder load. The battery would, therefore, not be required to directly start individual pumps or meet their instantaneous motor-starting current. Its power rating and energy capacity would be determined from the measured net-load profile of the feeder.

TERI's analysis for two APEPDCL substations indicates long-duration, low-C-rate requirements: 7.34 MWh/1.42 MW at one substation and 4.04 MWh/0.86 MW at another. It also shows that the need varies considerably by feeder. Storage should, therefore, be piloted only where measured load and generation data demonstrate material surplus and where it is more economical than curtailment or changes in agricultural supply scheduling.

DRE livelihoods, schools, and health facilities

The case studies reviewed include healthcare equipment, schools, a women-led bakery, a farmer training centre, and milling operations. These applications could be supported through convergence between the MNRE decentralised renewable-energy framework and health, education, rural-livelihood, and relevant state departmental programmes.

Recommended delivery model: Aggregate 25-50 sites within a district and procure the complete system together with five years of O&M. An initial pilot may provide 30% - 40% capital support, with relevant sector departments co-financing the service component. Vendor payments should be linked to measurable outcomes, including critical-load hours served, system availability, maintenance-response time and productive energy delivered.

Relatively higher support may be justified where beneficiaries have limited ability to pay, and the benefits extend beyond electricity-cost savings. However, public support should purchase a defined and verifiable service, not merely installed battery capacity. System sizing should, therefore, be based on the critical or productive load, and funding should not compensate for oversized equipment or inadequate O&M.

Third pathway: commercial uses

Where users capture direct and measurable savings, private finance should meet most of the project cost. Public intervention should reduce early-stage performance and financing risks rather than provide large capital subsidies.

C&I diesel displacement and peak management

Commercial and industrial consumers can value diesel displacement, reliable backup, power quality and peak reduction. Pilots across India include an approximately 500 kWh DG-replacement system and a 100 kWh DG-augmentation project. These applications can support larger portfolios and generate operating data quickly. Because the user captures much of the benefit, support should be limited to 10% - 20% performance grants, concessional finance or partial credit guarantees for initial portfolios.

Telecom backup

Telecom sites offer a potentially scalable application because backup requirements are relatively standardised and parallel operation across a portfolio can generate operating evidence quickly. Beyond financial support, an explicit policy measure – such as a DoT/TSP guideline recognising qualified second-life batteries as an approved backup category – may be needed to create a functioning market for this pathway. However, successful deployment requires compatibility with the site's DC architecture, reliable remote monitoring, distributed maintenance, and an adequate recharge window.

The public case for routine capital subsidy is limited because telecom operators and infrastructure providers capture the benefits of higher availability and lower diesel use. Initial intervention should therefore focus on first-portfolio risk through concessional finance, partial guarantees, or a small performance-linked grant. Support should taper once technical performance, warranty terms and insurability have been demonstrated.

Charging stations and electric-bus depots

A stationary second-life battery can support charging infrastructure where it reduces required connection capacity, defers an upstream network upgrade, absorbs on-site solar generation or limits demand charges.

However, the battery should not receive support merely because it is installed alongside a charger.

The PM E-DRIVE charging framework provides support for public charging infrastructure, including upstream infrastructure, EV supply equipment, battery-charging stations and battery-swapping stations through eligible public entities and their nodal agencies. A stationary peak-shifting battery is not clearly established as a standard independently subsidised item under this framework. It should, therefore, be tested only as a monitored pilot where its incremental benefit is demonstrated and where support does not duplicate assistance already provided for upstream infrastructure or charging equipment.

Commercial pathway	Public support	Basis for payment
C&I diesel replacement and peak management	Performance-linked grant, concessional finance, or partial credit guarantee for initial portfolios	Verified diesel displacement, system availability and service cost
Telecom backup portfolios	Limited first-portfolio grant, interest subvention or partial guarantee, with support tapering after validation	Site availability, backup duration, diesel reduction and maintenance response
EV charging and bus depots	Pilot viability-gap support only where storage produces a demonstrated incremental benefit	Avoided connection or upstream cost, renewable energy utilised, peak reduction and charger availability

Private users and service providers should finance the majority of commercial projects. Public support should be retained partly against operating performance, not paid entirely at commissioning.

Fourth pathway: distribution-system flexibility

DISCOM applications offer high system value, but they require the most careful siting, contracting and safety oversight.

The Ministry of Power framework recognises storage across generation, transmission and distribution, and utility resource-adequacy planning increasingly treats storage as a planning resource. This creates a policy basis for DISCOM pilots. It does not mean that repurposed batteries should be used immediately in every utility application. The first projects should address local, measurable needs and should be procured as services wherever possible.

Fixed storage as a non-wires alternative

A fixed second-life battery (SLB) system may be considered where it can reduce a feeder or transformer peak, manage voltage, increase solar hosting capacity or provide limited outage support. Site selection should compare storage with augmentation, feeder reconfiguration, smart-

inverter controls, dynamic export limits, demand response and temporary generation. A benefit-cost ratio of at least 1.2 in general is recommended for public support.

Mobile and relocatable storage

Some constraints are seasonal, temporary, or geographically shifting. Relocatable storage may support transformer works, planned outages, harvest loads, festivals, or rapidly changing rooftop-solar concentrations. It may also provide temporary backup in place of diesel generators during planned or unplanned outages, extending the diesel-displacement rationale used elsewhere in this paper to a mobile format. A provider-owned asset can be moved between pre-engineered sites and paid through an availability charge plus a measured network-service payment.

RDSS data and smart-metering infrastructure can help identify locations and establish baselines. A specific innovation approval, regulatory sandbox or non-wires-alternative framework is needed. Scale-up should depend on lifecycle cost and verified ability to defer or avoid a more expensive alternative.

4. Embedding the applications in existing policy

India does not need a separate subsidy scheme for every second-life battery application. Existing programmes can provide demand anchors, provided they are supplemented by a common framework for battery qualification, system safety, performance monitoring and end-of-life accountability. These amendments should be

sequenced: PM Surya Ghar and PM E-DRIVE clarifications prioritised in year one, PM-KUSUM and Ministry of Power framework changes in years one to two, and the Battery Waste Management Rules clarification treated as a precondition to be resolved before pilots scale, consistent with the dependency identified in this report.

Existing programme/ initiative	Proposed role	Decision or amendment required
PM Surya Ghar or its successor framework	Demonstrate residential solar-plus-storage on selected feeders where batteries can increase solar self-consumption and provide measurable DISCOM value.	Establish a targeted storage pilot; prescribe second-life battery qualification and hybrid-inverter interoperability; and define consumer rights, DISCOM dispatch rights and payment for flexibility. Storage is currently under consideration for the next phase, but no final decision has been reported.
PM-KUSUM Component C, Feeder-Level Solarisation	Test shared storage at selected solarised agricultural feeders to absorb surplus solar, manage reverse power flow and shift energy to later feeder demand.	Permit monitored storage pilots based on measured feeder load and solar-generation data. Require comparison with lower-cost alternatives such as curtailment and changes in agricultural supply scheduling. Component C explicitly includes feeder-level solarisation, but storage is not a standard scheme component.
MNRE decentralised renewable-energy initiatives with sector departments	Support reliable energy for livelihoods, schools, health facilities and community infrastructure.	Introduce results-based procurement, district-level aggregation, multi-year O&M and convergence with health, education, rural-development, and livelihood budgets. Payments should be linked to service availability rather than installed battery capacity.
PM E-DRIVE and public charging procurement	Test stationary buffer storage where it can reduce connection requirements, defer upstream investment, absorb solar generation or manage charging peaks.	Allow certified second-life storage as a monitored pilot item where its incremental benefit is demonstrated. Prevent duplication of assistance already available for upstream infrastructure, EVSE, battery-charging stations or swapping infrastructure.

Existing programme/ initiative	Proposed role	Decision or amendment required
Ministry of Power ESS framework and SERC regulations	Enable fixed or relocatable storage to provide distribution-level services such as peak reduction, local congestion management and renewable-energy shifting.	Develop technology-neutral procurement, second-life battery qualification, non-wires-alternative assessment, service-payment and DISCOM cost-recovery rules. The national ESS framework already recognises storage applications across distribution and other power-system functions.
Battery Waste Management Rules	Maintain traceability and lifecycle accountability from EV retirement through repurposing and final recycling.	Clarify the point at which an EV battery is transferred for repurposing, the allocation of producer, refurbisher and system-integrator responsibilities, EPR accounting and the obligation for authorised final recycling. The existing framework applies across battery types and recognises producers, recyclers and refurbishers, but the second-life chain requires clearer operational treatment.
BIS and CEA technical and safety framework	Establish minimum conditions for safety, interoperability, insurability, and market confidence.	Develop a second-life installation overlay covering battery provenance, SoH and RUL assessment, grading, accredited testing, complete-system certification, transport and re-testing triggers, installation, and fire safety. CEA safety and construction requirements for BESS should provide the system-level foundation, supplemented by standards specific to repurposed batteries.

Irrespective of the programme through which a project is supported, every second-life system should satisfy a common set of requirements:

Traceable battery provenance and ownership.

- Independent SoH and RUL assessment.
- Documented matching of the battery to the intended duty cycle.
- Certification of the complete system, including the BMS, power-conversion system and protection equipment.
- Performance warranty or an equivalent risk reserve.
- Remote monitoring and disclosure of operating data.

- Defined responsibility for operation, maintenance, and safety.
- Mandatory take-back and authorised final recycling.

This approach recognises that programme eligibility and technical eligibility are separate tests. A project may align with the objectives of an existing scheme, but it should receive public support only if the complete second-life system also meets the applicable safety, performance, and lifecycle requirements.

Existing programmes should create demand for defined energy services, while a common qualification framework should determine whether a second-life battery system is safe and accountable enough to deliver them.

5. A differentiated support framework

Public support should reflect who captures the benefit, whether important benefits remain unmonetised, and how mature the application is.

A uniform subsidy would risk over-supporting commercially viable projects while providing insufficient support for essential services and livelihood applications.

Commercial users that capture diesel savings, avoided demand costs or reliability benefits should finance most of the investment. Higher support may be justified where beneficiaries have limited ability to pay and where the project delivers public benefits that cannot be fully monetised.

Application	Indicative pilot ceiling	Rationale	Principal condition
Residential rooftop solar	Up to 40%, capped at INR 10,000/kWh and INR 30,000 for the reference 3 kWh system	Addresses household affordability while preserving a substantial consumer contribution	Consumer contribution of at least 50%; total public support not exceeding 50%; deployment limited to selected feeders
PM-KUSUM Component C feeder	Up to 30% for selected demonstrations	Establishes performance and cost evidence for shared storage on solarised agricultural feeders	Measured solar surplus; feeder-specific sizing; comparison with curtailment and supply rescheduling
Rural livelihoods	Up to 30-40%	Productive and shared-use systems may generate benefits that are dispersed or difficult for users to finance fully	Defined productive load; beneficiary or sector contribution; aggregated procurement and long-term O&M
Schools and community facilities	Up to 35-40%, with outcome-based O&M support	Continuity of essential services creates public value beyond electricity-bill savings	Specified critical loads, service hours, uptime and maintenance-response standards
Telecom backup	Up to 15-20% for initial portfolios, or financing support	Standardised loads and monetisable diesel savings should allow support to taper rapidly	Portfolio procurement, availability guarantee and verified diesel displacement
C&I applications	Up to 10-20%, or a partial credit guarantee	The private user captures most diesel, peak-management, and reliability benefits	Majority private finance and payment linked to verified operating performance
Charging stations and bus depots	Up to 20-30% viability-gap support for monitored pilots	Early projects may face utilisation, integration, and connection-cost uncertainties	Demonstrated avoided upstream cost, demand reduction or renewable-energy utilisation; no duplication of charging-infrastructure support

The proposed support bands should therefore operate **as pilot ceilings, not standard entitlements**. These ceilings refer to capital-expenditure support (performance-linked payments described elsewhere in this framework are treated separately). The actual level of assistance should be established through competitive procurement and limited to the minimum amount required to make the project viable.

The viability-gap rule

Public assistance should be the lowest of the applicable percentage ceiling, the rupee ceiling and the residual viability gap established through competitive procurement. The viability gap should be calculated after accounting for beneficiary and departmental contributions, monetisable savings, service revenues,

concessional finance and support from other public programmes. Eligible costs should be limited to the equipment and services required to deliver the defined storage service, excluding land, unrelated equipment, recoverable taxes, and expenditure financed elsewhere.

At least 20% - 30% of the assistance should be linked to verified operating performance and released over one to three years. Support ceilings should be reviewed after initial procurement rounds and reduced as costs fall, performance evidence improves, and commercial finance becomes available. Higher support should be justified by a verified public benefit or affordability constraint, not merely by the use of a second-life battery.

Public support should cover the minimum demonstrated viability gap and pay for measurable public value, not installed battery capacity alone.

6. Risks, dependencies, and open questions

The pathways set out above depend on institutions, cost trends and evidence that this paper cannot itself secure. A credible programme should name these dependencies rather than assume them away.

Institutional dependencies

Three of the four pathways - residential benefit-sharing, PM-KUSUM feeder storage and distribution-system flexibility - rely on active DISCOM participation: contracting for flexibility, paying availability charges and passing through benefits. DISCOM financial health and operational capacity vary widely across states. A pathway that assumes a functioning counterparty may stall for institutional reasons unrelated to battery performance or market demand, so programme design should identify which states or DISCOMs have the balance-sheet and metering capacity to participate credibly rather than treating DISCOM engagement as uniform.

The common requirements in Section 4 - mandatory take-back, performance warranties, insurability - depend on the Battery Waste Management Rules clarifying, before pilots scale, which party is liable for a battery once it is transferred for repurposing. Until that chain is settled, warranties and take-back obligations have no clear counterparty to enforce them against. This should be treated as a precondition for scale-up rather than one item among several institutional amendments.

Insurability is listed as an eligibility condition, but it presumes insurers are willing to underwrite second-life battery risk on some terms. If the domestic insurance market currently has limited appetite for this risk, mandating insurability will not by itself produce a market for it. Standardised test protocols that insurers can price against, or a public risk-sharing backstop for the pilot phase, may be a necessary complement rather than an assumed given.

Cost and timing risk

The economic case for repurposing rests on the 30-50% price advantage stakeholders expect over new batteries. New lithium-ion cell prices continue to fall, and the pathways are intended to scale after 2030; if new-battery costs fall faster than second-life costs, the advantage could narrow or close before the market matures. Programme design should be stress-tested against a scenario in which the price gap compresses, with pathway prioritisation revisited if it does.

The safety and certification regime recommended in this paper - independent SoH/RUL assessment, complete-system certification, remote monitoring - carries a cost that is largely fixed per installation rather than proportional to system size and is likely to weigh far more heavily on a 3-kWh residential system than a 400-kWh commercial one. Residential deployment may require a standardised and proportionate compliance pathway, using type-tested configurations, approved component combinations and portfolio-level verification to reduce per-system compliance costs without relaxing safety requirements.

The 100-150 MWh pilot programme presumes a sufficient volume of retired batteries is available on a compatible timeline. This paper does not establish current feedstock volumes or their composition by vehicle segment; two-wheeler and three-wheeler batteries retire earlier and differ materially in chemistry and format from four-wheeler packs. A basic feedstock assessment by segment would help confirm that the pilot's scale and timing are realistic.

Strengthening the support framework

The support ceilings in Section 5 are presented as reasonable judgements about who captures benefit, but

the paper does not show how the specific percentages were derived or benchmarked against comparable subsidy programmes. A brief methodological note - indicating, for example, the reasoning behind the residential 40% ceiling relative to the C&I 10-20% band - would pre-empt an obvious reviewer question and make the bands easier to defend or revise.

The measure of policy success proposed in the concluding section is qualitative: lower risk premiums, stronger warranties, declining subsidy requirements. Illustrative go/no-go thresholds - for example, a maximum acceptable failure rate, or a minimum required decline in subsidy levels between procurement rounds - would give the monitoring and evaluation framing more operational bite.

7. A measured pathway to scale

India should act before the retirement wave arrives, but it should build the market around evidence rather than volume targets alone.

The case for repurposed EV batteries is strongest when a verified battery is matched to a service that does not require new-battery performance. Residential solar, rural productive loads, essential public facilities, diesel displacement, charging buffers and selected distribution applications provide a balanced starting portfolio. Together they can generate the technical, commercial and regulatory evidence needed for a larger market after 2030. The distinct contribution of this paper is to replace a single, uniform subsidy for second-life batteries with an application-led, evidence-based framework in which public support scales with verified need rather than with the mere availability of retired batteries.

The role of government is to create confidence and purchase public value. It should establish common rules for testing, system safety, traceability, warranties, and final recycling; open limited windows under existing schemes; and use competitive, performance-linked support to close genuine gaps. It should not guarantee a market for batteries that lack provenance, application fit or a credible service proposition.

A three-year, 100-150 MWh programme offers a prudent next step. It is large enough to establish financial and operating evidence, but small enough to correct course. If successful, the programme should leave behind lower risk premiums, standard contracts, stronger service revenues and declining subsidy requirements. That, rather than the number of batteries deployed in the first phase, should be the measure of policy success.

Policy decision: Launch a coordinated market-development programme, housed at MNRE as the nodal ministry and steered through an inter-ministerial group with MoP, MHI and MoEFCC/CPCB, with common technical rules and application-specific support. Begin with well-instrumented pilots and scale only those models that demonstrate safety, reliability, and lower lifecycle service cost. Permit qualifying second-life battery systems to compete on technology-neutral terms in eligible decentralised-energy programmes, subject to application-specific appraisal and the safety, performance, traceability, and lifecycle conditions set out in this paper.

Selected evidence base

1. TERI, Beyond Mobility: Unlocking the Second-Life Battery Opportunity, Volumes I-III (2026).
2. TERI, Inputs to MNRE on PM Surya Ghar 2.0: Enabling Storage-Linked Rooftop Solar Penetration (11 August 2026).
3. TERI, India SLB Case Studies database and filled pilot data-collection questionnaire.
4. TERI, Energy Storage at the Distribution Level: Technologies, Costs and Applications (2021).
5. MNRE, PM-KUSUM guidelines and programme portal; Framework for Promotion of DRE Livelihood Applications.
6. MHI, PM E-DRIVE Operational Guidelines for Deployment of EV Public Charging Stations (26 September 2025).
7. Ministry of Power, National Framework for Promotion of Energy Storage Systems and utility resource-adequacy measures.
8. MoEFCC, Battery Waste Management Rules, 2022 and amendments through 2025; CEA/BIS safety and standards work.

Note: Support levels are proposed pilot ceilings and require validation through competitive procurement and monitored deployment. References to successor PM Surya Ghar or PM-KUSUM arrangements are policy proposals, not statements of current entitlement.

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FOR MORE INFORMATION

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