

The Panel's Second Life: Building a Solar-Recycling M&A Platform

Acquisition diligence and capital allocation across collection material recovery and producer responsibility

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Abstract

A solar-recycling acquisition depends on the ability to deliver an accountable service and collect its proceeds. This paper develops a framework for acquiring a collection and preprocessing platform whose specialist treatment remains outsourced. It connects retirement evidence, regulatory responsibility, reuse decisions, feedstock contracting and downstream acceptance to the transaction perimeter. Ten primary references provide the regulatory, technical and issuer-policy context; they do not establish the economics of an acquisition target.

A fictional worked case follows nominated deliveries through intake, recovery, saleability, service fees, material netbacks and working capital. It separates standalone operations from timed integration benefits and reconciles enterprise consideration to the equity buyer's cash flows. Under its stated assumptions, integrated enterprise value is USD 4.318 million at a 12% unlevered rate. The conditional enterprise-price ceiling is USD 3.522 million at a separate 16% equity hurdle. An illustrative USD 4.000 million offer produces negative equity net present value of USD 0.478 million and requires USD 1.308 million of additional post-closing equity liquidity. The immediately amortizing loan fails the first-year coverage diagnostic, making financing a separate unresolved condition.

The proposed diligence and integration method translates uncertain quantities and operating dependencies into evidence requests, completion conditions, price adjustments and auditable contingent consideration. Scenario tests identify the effects of weaker feedstock, material quotations, slower collections and delayed integration. All numerical inputs are fictional author assumptions. Engineering feasibility, national implementation, target-specific liabilities and executable financing require independent transaction evidence before the framework can support an actual acquisition decision.

JEL Classification: G34, Q42, Q53, L65

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1. Establishing the Evidence Boundary

This paper proposes an acquisition framework for a solar-recycling platform spanning collection, triage, treatment and producer-responsibility services. Its analytical contribution is the separation of five questions: which modules become available, who pays, which route is lawful, which outputs a customer accepts, and when the platform receives cash. The framework is a proposed

decision tool. Public evidence does not establish the financial performance of an unidentified acquisition target.

The IEA PVPS September 2025 status report records 48,395 tonnes of photovoltaic module waste collected across 18 European countries in 2022. Its retirement projections rely on stated installation and lifetime assumptions, including different median lives for utility-scale and distributed systems in one reproduced scenario. The observed collection figure has a defined geography and reporting year. The scenario curves describe modelled future flows. Neither measure establishes a prospective buyer's accessible supply. [1]

For transaction screening, the proposed first exhibit is a retirement-cohort register at project level. Each record should identify location, owner, installation vintage, module technology, number and weight of modules, condition, reason for removal and expected decision date. Sources should distinguish a completed decommissioning, an approved repowering plan, a warranty return and an owner's preliminary intention. A proposed volume should remain outside the committed-feedstock category until the contract and delivery terms are examined.

The register should also preserve the difference between panels and tonnes. An equipment supplier's panels-per-hour rating needs a documented module-weight assumption before comparison with an intake agreement denominated in tonnes. Broken modules, packaging, frames and non-module equipment should have separate weight fields. For mixed loads, the proposed reconciliation begins with weighbridge records and ends with a documented allocation to accepted modules, packaging and rejected material. Any conversion factor supplied by management should be identified as a management estimate and tested against representative deliveries.

Table 1. Proposed evidence ladder for retirement supply

Evidence state	Record to obtain	Treatment in the acquisition case
Installed stock	Site list, vintage and technology	Context for cohort mapping
Intended removal	Owner decision, timing and scope	Separately identified opportunity
Contracted delivery	Executed agreement and acceptance terms	Eligible for contract-specific assessment
Accepted intake	Weight ticket, title and condition record	Reconcile to the inventory ledger
Completed service	Treatment records and customer acceptance	Reconcile to invoicing and recognition

Notes: Analytical framework proposed in this paper; categories are diligence states, not measured market shares or default conversion probabilities.

The buyer should request a reconciliation of the seller's commercial pipeline to this ladder. A single project can appear in an owner's repowering list, a collector's opportunity list and a recycler's delivery forecast. The diligence team should assign a project identifier and reconcile these appearances before aggregating volumes. The acquisition perimeter should state which legal entity controls the collection agreement, the logistics instruction, the treatment obligation and the right to sell outputs.

Capacity expansion should have an explicit evidence threshold. The proposed investment committee test asks for route-level delivered volumes, a documented acceptance envelope and a commissioning plan matched to those deliveries. Uncontracted cohorts can remain in a separately costed development case. The base acquisition case should be assessed using the verified rights and obligations that transfer at completion. The empirical evidence reviewed here does not

establish an actual target's cohort-conversion parameter. The companion worked case uses fictional author-selected capture inputs for illustration.

2. Identifying the Payer and the Regulatory Perimeter

EU producer responsibility requires cohort-specific treatment. Directive (EU) 2024/884 amended WEEE financing provisions for photovoltaic panels placed on the market from 13 August 2012, covering private-household and other-user routes through their respective articles. Its recitals preserve the relevance of general waste-law provisions for earlier cohorts. The directive set a 9 October 2025 national-transposition deadline. This research has not verified every Member State's implementation. Earlier panels should therefore undergo jurisdiction-specific payer analysis. [6]

The consolidated WEEE text places photovoltaic panels in the large-equipment category. Annex V specifies minimum category-level recovery of 85% and preparation for reuse/recycling of 80% from August 2018. Article 11 excludes preliminary sorting and storage from target achievement. These are weight-based regulatory measures. They do not specify the purity, selling price or customer acceptance of each recovered constituent. [7]

US federal guidance supplies a different perimeter. EPA's page updated on 30 September 2026 describes discarded panels under RCRA and identifies conditional recycling exclusions and state variation. The agency describes a proposed federal universal-waste rule as under development. A buyer should obtain advice on the rules actually applicable to the origin, transit and destination of each proposed route; this paper does not treat that proposal as effective law. [4]

The proposed commercial register should name the contracting payer separately from the panel owner and the person arranging removal. Relevant documents include the producer's scheme registration, the scheme's procurement contract, the asset owner's decommissioning contract and the recycler's service order. Each should specify the billable event, covered costs, contamination rules, packaging responsibilities and evidence required for payment. A statutory duty should be recorded in its legal category; a platform receivable should require a verified contractual claim and identified debtor.

First Solar's 2025 Form 10-K provides a company-specific illustration. Its legacy programme allocated collection/recycling costs to First Solar for qualifying contracts, while end-users undertook disassembly, packaging, notification and return of ownership. The disclosed cost estimate includes freight, material, labour, capital and by-product credits. Those covered-contract terms do not establish the payer for other manufacturers or provide an acquisition platform with rights to the company's funded obligations. [9]

For an acquisition, the proposed legal perimeter schedule should separate permitted operating assets, contractual service rights, producer-scheme obligations, customer deposits and historical environmental exposures. An asset sale should be reviewed for the permits and consents required by that structure. A share purchase should be reviewed for obligations retained within the acquired entity. Counsel should determine the applicable responsibility and transfer conditions in both structures.

The commercial question for an EPR-services bolt-on is the exact paid function: registration support, reporting, collection coordination, treatment procurement or operation. The buyer should obtain the contractual basis for each fee and examine service-level obligations, audit rights,

producer default, scheme termination and change of control. Any proposed cross-selling revenue should be presented as a management estimate until customers accept the service and commercial terms. The acquisition framework assigns value to documented service economics and separately records the cost of satisfying inherited obligations.

3. Separating Reuse, Repair and Waste

EPA's current frequent questions distinguish legitimate reuse from a decision to discard. Used modules sent for legitimate reuse or repair are addressed separately from modules determined to be unusable and sent to recycling or disposal. EPA recommends separating reusable and unusable panels and retaining documentation. Its guidance also addresses generator determinations, conditional exclusions and hazardous residuals after frame removal. These federal interpretations carry stated conditions; they do not classify a seller's entire stockpile. [5]

IEA PVPS's February 2026 second-life report discusses visual inspection, current-voltage characterisation, electroluminescence imaging and insulation testing for triage. It reports labour and scaling constraints on repair and addresses economics qualitatively. Its laboratory, pilot and field cases do not supply a universal resale yield, remaining service life or warranty for an acquisition target. [8]

The proposed operating decision begins before a load is dispatched. The intake team should obtain module identity, removal reason, visible condition and ownership records. A documented triage protocol should assign responsibility for eligibility checks, test selection, quarantine, release and final route. Test limits and sampling decisions should be agreed by the responsible technical specialist, with the evidence retained against the identifiable module or lot. The buyer should review calibration, operator training, exceptions and retest records.

For stock marketed as reusable equipment, the diligence team should ask for an identifiable intended application, completed test records, customer acceptance specifications and a route for units that fail acceptance. Storage should retain the status of each lot. A rejected resale lot should receive a recorded classification decision and the corresponding inventory and cost treatment. This proposed control connects technical evidence to stock valuation; the framework assumes no automatic resale uplift.

EU shipments require their own evidence review. WEEE Annex VI addresses invoices or transfer contracts identifying direct reuse and functionality, testing records, the holder's declaration and transport protection, with defined exceptions for certain business-to-business transfers. The applicable contemporary shipment regime requires additional legal checking. A product description on an invoice should be assessed alongside the evidence specified for its route. [7]

The proposed acquisition review should separate three revenue activities. Triage is a testing service with a defined fee and disposition responsibility. Refurbishment is a repair operation with documented labour, parts, retest and warranty exposure. Resale is a product sale with its own buyer, acceptance process, payment terms and potential returns. Where one company performs all three, the buyer should request separate unit economics and a reconciliation of internal transfers. This allows the proposed purchase-price discussion to identify the activity producing the recorded contribution.

Finally, the seller should provide the ageing of all modules awaiting a disposition decision. Diligence should identify the costs of clearing rejected stock, outstanding customer instructions

and any deposits associated with the material. The buyer should request evidence supporting insurance coverage for handling, repair and resale activities and obtain specialist review of policy limitations. A second-life business should enter the acquisition perimeter with a defined qualification process, identified buyers and allocated responsibility for subsequent product performance. The paper proposes these gates without forecasting the proportion of modules that pass them.

4. Testing Recovery from Intake to Saleable Output

The April 2026 IEA PVPS recycling study combines commercial and pilot evidence from five contributors to its 2025 survey. For comparative analysis it uses a boundary around separation of the cell fraction from glass and polymers; some downstream recovery and purification are excluded. It expressly warns that reported material outputs can include streams directed to energy recovery or landfill and that destinations were incompletely specified. Input mixes and energy-data completeness also differ. [2]

First Solar reports in its 2025 filing that its process recovers more than 90% of module materials for reuse. This is an attributed manufacturer statement about its operations. It does not supply a crystalline-silicon recycler's achievable purity, accepted sales or processing margin. A transaction should examine the process and feedstock actually acquired. [9]

The proposed diligence framework defines three separate measures. Recovery yield is the mass of a specified constituent recovered against a stated input denominator. Purity is the composition of a particular recovered fraction, assessed against a defined test method. Saleable output is the quantity accepted under an actual customer's specification, including any moisture, contamination, deduction and rejection terms. The diligence schedule should state all denominators and measurement points explicitly.

Table 2. Proposed output-quality bridge

Process stage	Evidence for the buyer	Commercial question
Accepted module intake	Weight, technology and composition records	What material entered the obligation?
Separated fractions	Batch weights and reconciled losses	What did the process produce?
Further purification	Assays, reagent use and subcontract terms	What additional cost remains?
Customer acceptance	Specification, certificate and deductions	What quantity qualifies for payment?
Cash settlement	Invoice, dispute and receipt records	What net amount was collected?

Notes: Proposed evidence requirements; no target yields, purities or selling prices are assumed.

The buyer should witness representative batches across the module families admitted by the seller's contracts. The proposed protocol should account for glass-glass and glass-backsheet designs, framed and frameless modules, intact and broken loads, and technology-specific restrictions. Results should identify the tested feedstock and operating conditions. An advertised maximum, a laboratory result and a sustained production result should each retain its stated evidence category.

For each output, the proposed data room should include sale invoices, specifications, assays, freight documents, rejected loads and any refining or treatment charges. Concentrated cell material should have a named next processor and an agreed price basis. Where a downstream partner performs purification, the transaction review should examine its capacity reservation, acceptance criteria, payable-metal calculation and termination rights. The buyer should record

whether the acquired platform owns the recovered material or performs a tolling service for another owner.

Residuals belong in the same reconciliation. The proposed operating account should identify dust, wastewater, polymer fractions, filter media and rejected materials, together with destination and treatment cost. Specialist reviewers should assess permits, emissions, worker exposure and any hazardous-residual classification. Capital needs for dust collection, water treatment, laboratory work and quality control should enter the transaction case where target evidence supports them. The investment committee should request a complete intake-to-cash bridge for the acquired process, with unresolved downstream steps and their costs shown explicitly.

5. Contracting Feedstock and Converting Service into Cash

NREL's March 2021 policy survey identified limited cost evidence and incomplete reporting of dismantling, collection, sorting, handling, transportation and operating costs. Its quoted US recycling prices were explicitly anecdotal and historical. This paper uses that evidence to specify the scope of cost diligence. It provides no current market fee or target margin. [3]

Comstock's quarter-ended-30-June-2026 filing illustrates a specific accounting boundary. Note 13 states that recycling revenue is deferred on receipt of panels and recognised after service completion and issuance of a destruction certificate. Its contemporary commissioning and refining statements include ongoing work and plans. The paper does not treat an intended operating date as a verified subsequent outcome or adopt the filing's unreconciled aggregate billing figures. [10]

The proposed feedstock contract should be reviewed across volume, quality, timing, price and responsibility. Volume terms should distinguish a binding minimum, a capacity reservation, an estimated schedule and an exclusivity arrangement without a minimum. A forecast from a large asset owner should retain its contractual status. Assignment and change-of-control provisions require review before counting the agreement as part of the acquired platform.

Quality provisions should define admitted technologies, module condition, hazardous characteristics, packaging and associated equipment. The buyer should request a procedure for inspection, rejection, repricing and disputed weights. Timing provisions should allocate transport delays, delivery windows and congestion. For multi-site contracts, each route should have a cost build-up showing collection, consolidation, transport, unloading and treatment. Route quotations and recorded experience should support those entries; management estimates should remain identified.

The proposed price schedule should identify the payer for collection, treatment, testing and documentation, together with any commodity participation. Review should cover indexation, surcharges, minimum charges, credits and the event that creates an invoice. It should also identify responsibility for residual disposal and rejected material. A fixed intake fee with an open-ended obligation to store or refine the material deserves a separate cost-to-complete assessment using target evidence.

The diligence team should reconcile customer deposits and advance invoices to the physical material received, work completed and remaining obligations. This requires a lot-level link between inventory, work orders, service certificates, invoices and cash receipts. The proposed closing statement should explicitly address materials held for customers and the expenditure still

required to satisfy prepaid services. Deposit cash and the associated obligation should be reviewed together when negotiating working capital and liability treatment.

Concentration should be examined through executed documents and actual receipts. A buyer should request volume and revenue by counterparty, project, origin and contract term, followed by the dependency on individual logistics or offtake partners. New contracts can be assessed through completed deliveries, accepted treatment evidence and payment performance. The proposed acquisition case should identify the remaining evidence gap for agreements with limited operating history. The empirical evidence reviewed here does not establish an actual target's receivables collection period, credit-loss rate or conversion of pipeline tonnage into revenue. The companion worked case uses fictional author-selected inputs for these parameters.

6. Assembling the Acquisition Platform

The proposed acquisition thesis combines capabilities only where the buyer can document the interface between them. A collection business should contribute verified customer access and route execution. A recycler should contribute a permitted process, demonstrated throughput and accepted outputs. An EPR-services business should contribute defined paid compliance functions and auditable reporting. A reuse specialist should contribute qualification records, identified product buyers and allocated warranty exposure. Each capability should have an evidence-backed standalone case before proposed integration benefits are added.

Table 3. Proposed transaction-perimeter diligence heatmap

Perimeter	Completion evidence	Open-item treatment proposed
Collection rights	Executed transferable contracts and route records	Exclude unsupported pipeline from committed volume
Operating authority	Applicable permits, conditions and consent analysis	Make required approvals explicit conditions
Process performance	Witnessed representative runs and mass balance	Defer unproven expansion investment
Material sales	Accepted specifications and payment history	Separately cost downstream qualification
Inherited obligations	Deposits, stored lots and residual records	Negotiate quantified cost-to-complete treatment
Integration	Named owners, interfaces and implementation budget	Stage expenditure against verified milestones

Notes: Proposed decision gates; severity should be assigned during target-specific diligence. No operator is ranked by this table.

The transaction perimeter should include the people and contractual knowledge required to operate those interfaces. The proposed diligence plan should identify who approves intake, who classifies material, who releases output and who certifies service completion. Employment arrangements, laboratory access, process licences, maintenance support and downstream relationships should be reviewed for continuity after closing. A process licence should have a verified field of use, territory, fee basis and transfer position.

The valuation bridge should be prepared from verified historical accounts and contract-specific adjustments. The proposed first layer is the seller's reported result, reconciled to statutory accounts and receipts. The next layer identifies supported normalisation items and the cost of completing outstanding services. Expansion capital, additional working capital and proposed integration costs should then be shown separately. Proposed synergies should identify the

activity, accountable owner, evidence required, implementation expenditure and timing assumption. No acquisition multiple or investment return is estimated in this core framework.

The integration roadmap should begin with control of material and obligations. Before closing, confirm route permissions, contract continuity, stock ownership and required consents. At transfer, reconcile customer-held material, prepaid services, output inventory and unresolved classification decisions. The first operating phase should validate traceability, acceptance and reporting across the combined perimeter. Subsequent capacity decisions should require representative production evidence, contracted deliveries and qualified destinations for outputs.

A cross-border expansion should receive a fresh jurisdiction and route review. The buyer should document local producer-responsibility functions, waste/product classification, shipment conditions, site permissions and customer evidence requirements. The proposed framework therefore treats a country launch as a separate investment gate with a defined budget and decision record. Evidence from one operating route remains attached to that route until the new route is examined.

The final investment-committee submission should state what transfers, what has been demonstrated and what remains proposed. It should reconcile supply rights, payer obligations, lawful routes, output acceptance and cash settlement in one transaction perimeter. On that basis, the panel's second life becomes a specific acquisition programme with documented responsibilities and staged capital decisions. Public research supports the questions to ask; target records and specialist diligence are required to approve a transaction.

7. Model perimeter and cash-flow conventions

This fictional author-assumption model examines Buyer P's acquisition of Target R, a regional solar-module collection and preprocessing hub. Every input is invented for transparent transaction arithmetic. Every result is derived from those inputs. The illustration supplies no observed project performance, market benchmark, forecast, probability, process validation or valuation opinion. Its purpose is to expose the acquisition conditions that connect accepted feedstock, saleable outputs, earned fees and cash available to an equity buyer.

The acquired perimeter contains intake, sorting, dismantling and mechanical separation. Specialist treatment of the silicon-rich fraction remains a contracted service outside that perimeter. A USD 45-per-accepted-tonne specialist toll forms part of processing cost. Collection is a separately priced activity affecting 65% of accepted tonnes. The remaining feedstock arrives through other counterparties; the model assigns no collection revenue or inbound collection charge to that share. Acquiring the hub creates no ownership interest in the specialist processor.

The horizon contains closing at time zero and ten operating years, with annual cash flows placed at year end. All mass quantities are metric tonnes. All monetary quantities are USD. Prices and costs remain constant; inflation, taxes, tax shields, foreign exchange, transaction fees and stochastic price movements are omitted. There is no continuing-business terminal value or plant salvage receipt. Normal receivables and operating stock are liquidated at carrying value at the end of year ten, and outstanding operating payables are settled. Closure and decommissioning costs are omitted; an actual buyer would need separate evidence and allowances for those items.

Ramp expenditure is USD 0.60 million at closing, USD 0.80 million in year one and USD 0.30 million in year two. Annual maintenance capital expenditure is USD 0.18 million. Closing also

funds USD 0.15 million of operating stock and prepayments. These amounts are additional to acquisition consideration. The ten-year assumptions are identical for the standalone and integrated operating cases except for the explicitly listed synergies and integration expenditures.

Table 4. Fictional acquisition perimeter and feedstock assumptions

Item	Value	Unit / definition
Rated / available incoming capacity	12,000 / 10,200	tonnes/year; 85% availability
Ramp years one / two / three / four onward	55 / 75 / 90 / 100	% of available capacity
Contract nominations / realization	8,500 / 90	tonnes/year / %; no delivery guarantee
Accessible uncontracted pool / capture	10,000 / 15	tonnes/year / %; separate from nominations
Feedstock acceptance	92.000	% of screened delivery tonnes
Collection share / fee / cost	65 / 70 / 65	% / USD per accepted t / USD per screened t
Processing fee / processing plus specialist toll	210 / 150	USD per accepted tonne
Fixed opex / annual maintenance capex	0.85 / 0.18	USD million
Close / year-one / year-two ramp capex	0.60 / 0.80 / 0.30	USD million

All inputs are fictional author assumptions. Target R is the collection/preprocessing hub; the specialist silicon-rich processor remains outside the acquired perimeter.

8. A tonne enters the model only after the intake gate

Target R's fictional rated incoming preprocessing capacity is 12,000 tonnes annually. Applying 85% availability gives 10,200 tonnes. Ramp factors of 55%, 75%, 90% and 100% produce operating limits of 5,610, 7,650, 9,180 and 10,200 tonnes in years one through four. Availability and ramp are separate multipliers. Neither quantity establishes permitted capacity, vendor capability, labour readiness or demonstrated recovery performance.

The feedstock side starts with 8,500 tonnes of annual contract nominations and a 90% realization assumption. A separately defined accessible uncontracted pool contains 10,000 tonnes, with 15% capture. The pool excludes nominated contract tonnes. Applying 92% intake acceptance to each stream produces 7,038 contract-eligible tonnes and 1,380 uncontracted-eligible tonnes; total eligible supply is 8,418 tonnes. Nominations carry no modelled compulsory-delivery payment or take-or-pay remedy. Their realization rate is an explicit author assumption.

Accepted and preprocessed volume equals the lower of eligible supply and ramp-limited available capacity. Contract-eligible material receives intake priority. Year-one throughput is consequently 5,610 tonnes, entirely allocated to the contract stream. Year two reaches 7,650 tonnes. From year three, annual accepted throughput is 8,418 tonnes. The remaining physical capacity earns no fee and receives no assumed replacement feedstock. An acquisition premium for fuller utilization would require a separate, evidenced volume case.

Delivery screening is modelled before the acceptance gate. Screened deliveries equal accepted throughput divided by the acceptance fraction. At the mature base volume, 9,150 delivered tonnes support 8,418 accepted tonnes and 732 rejected tonnes. Collected screened tonnes incur inbound collection cost even when part of the delivery fails acceptance. Gate rejects incur USD 12 per rejected tonne. Collection and processing fees apply exclusively to accepted tonnes that are preprocessed during the year. Capacity-declined eligible supply is never screened, stored, invoiced or carried as a backlog.

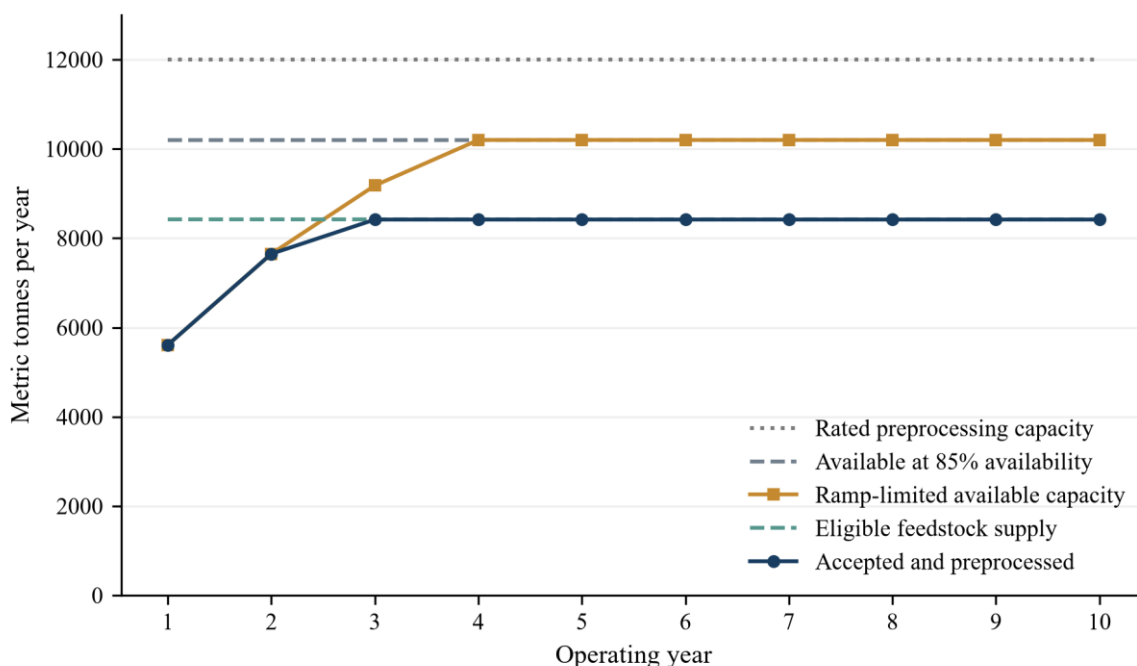
This design makes supplier consent, module identity, contamination rules, delivery calendars and rejection responsibility directly relevant to price. Each item changes either eligible supply, the screened-to-accepted ratio or cash cost per accepted tonne. The model provides no assumed right to redirect rejected modules to a free disposal route.

Table 5. Accepted feedstock and capacity reconciliation

Year	Ramp capacity t	Eligible supply t	Accepted contract t	Accepted uncontracted t	Screen rejects t	Processed t
1	5,610	8,418	5,610	0	487.826	5,610
2	7,650	8,418	7,038	612	665.217	7,650
3	9,180	8,418	7,038	1,380	732	8,418
4	10,200	8,418	7,038	1,380	732	8,418

Accepted tonnes are preprocessed in the same year; no backlog or revenue on declined capacity. Contract-eligible tonnes receive priority. Gate rejects do not earn fees.

Figure 1. Fictional feedstock and preprocessing capacity



Accepted preprocessing is constrained by ramp capacity in years one and two, and by eligible feedstock from year three. Rated and available tonnes are separate quantities.

9. Recovery, saleability and netback are different deductions

The illustrative accepted module composition is 68% glass, 12% aluminium, 1.5% copper, 3.5% silicon-rich fraction and 15% initially nonrecoverable material. These fractions total 100%. They are an accounting composition assumption; no particular module technology or installed cohort is represented. Recovery and buyer acceptance are applied separately to each potentially recoverable fraction.

Glass has 88% process recovery and 85% saleable acceptance of recovered material. Aluminium uses 96% and 96%; copper uses 85% and 90%; silicon-rich product uses 55% and 65%. The resulting saleable fractions of accepted input are approximately 50.864%, 11.059%, 1.148% and 1.251%. Total saleable output is 64.322%; total process residue is 35.678%. The residue includes initial nonrecoverable material, process losses and recovered outputs that fail saleability

acceptance. The model assigns all such material to disposal at USD 55 per tonne. It assumes no undocumented resale or zero-cost destination.

Each product has a raw quotation, a separate contractual offtake haircut and outbound transport. For aluminium, the fictional USD 1,500 quotation becomes a USD 1,350 offtake receipt after a 90% quotation factor. Deducting USD 85 outbound transport gives USD 1,265 per saleable tonne netback. Glass, copper and silicon-rich product follow the same calculation with their own inputs. Raw quotation is never multiplied by all incoming module tonnes. Only saleable product mass earns material revenue.

The standalone year-three unit bridge begins with USD 255.50 of gross service fees per accepted tonne. A 2% fee collection loss reduces collectible fee revenue to USD 250.39. Material netback adds USD 228.13. Inbound collection subtracts USD 45.92, processing and specialist tolling subtract USD 150.00, process-residue and gate-rejection handling subtract USD 20.67, and allocated fixed overhead subtracts USD 100.97. Derived EBITDA is approximately USD 160.95 per accepted tonne, or USD 1.355 million annually at 8,418 tonnes.

Processing cost comprises labour USD 55, energy USD 28, consumables USD 22 and specialist tolling USD 45 per accepted tonne. Outbound transport is deducted once inside the netback bridge. In the annual accounts it appears as an operating cost against gross offtake sales. The two presentations reconcile. A change in product specification can affect both saleable mass and price; the present model keeps those mechanisms separate so a reader can identify which assumption changed.

Table 6. Fictional mass recovery and netback assumptions

Product	Input %	Recovery %	Saleable acceptance %	Raw / offtake / netback USD per t	Saleable t per accepted t
Glass	68.000	88.000	85.000	45.00 / 42.75 / 28.75	0.508640
Aluminium	12.000	96.000	96.000	1500.00 / 1350.00 / 1265.00	0.110592
Copper	1.500	85.000	90.000	6500.00 / 5980.00 / 5760.00	0.011475
Silicon-rich product	3.500	55.000	65.000	900.00 / 720.00 / 600.00	0.012513
Initial nonrecoverable fraction	15.000	n/a	n/a	disposal 55 USD/t	n/a
Total saleable / total residue	n/a	n/a	n/a	n/a	0.643219 / 0.356781

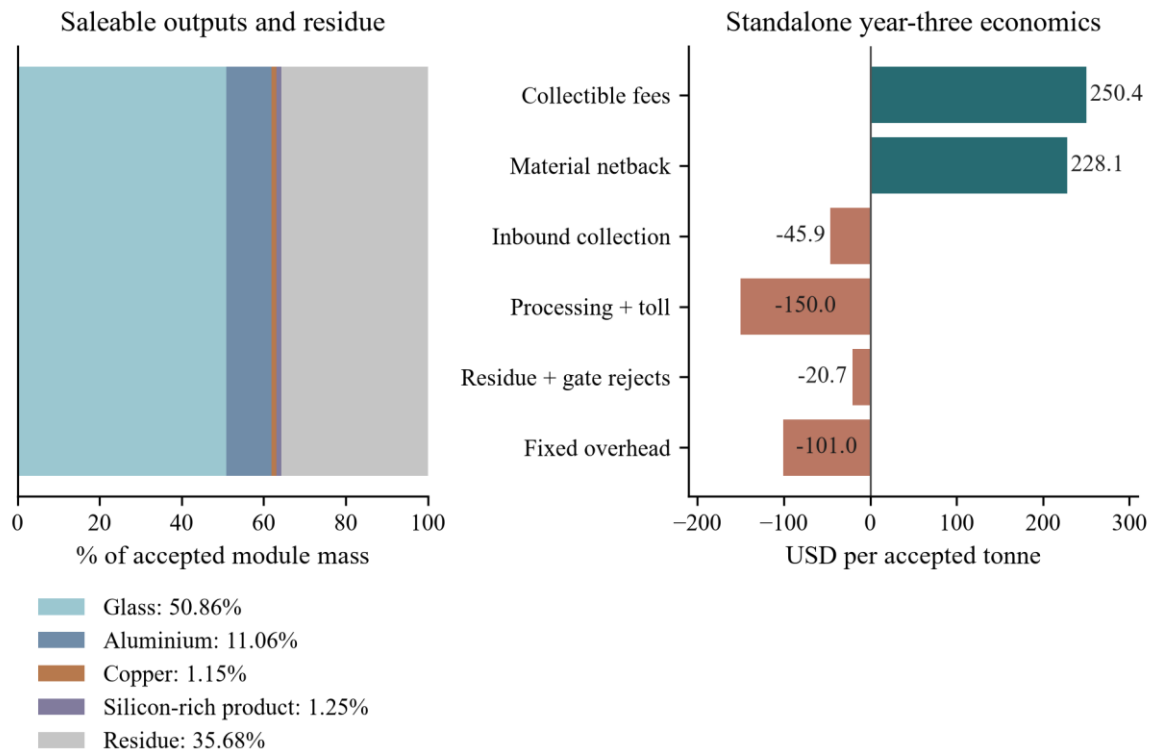
Offtake price equals raw quote multiplied by assumed offtake fraction; netback subtracts outbound transport. Recovery losses and quality rejects join the original nonrecoverable fraction. These yields do not establish technical feasibility.

Table 7. Standalone year-three unit economics

Line	USD per accepted tonne
Gross earned collection and processing fees	255.500
Credit loss deduction	-5.110
Material netback	228.126
Collection cost including screened rejects	-45.924
Processing including specialist toll	-150.000
Process residue and gate rejects	-20.666
Fixed overhead	-100.974
EBITDA	160.951

Outbound transport appears once inside material netback. Collection cost uses screened tonnes; fees use accepted tonnes.

Figure 2. Fictional mass balance and unit economics



Illustrative saleable outputs plus process residue equal accepted module mass. Standalone year-three economics include collected screened tonnes, specialist tolling, disposal and fixed overhead.

10. An invoice is followed through the cash cycle

Gross fees represent amounts earned for the modelled service; collectible fee revenue deducts the assumed permanent 2% collection loss. This loss receives no later recovery. Fee receivables equal collectible fee revenue multiplied by 120/365. Material receivables use 45/365 of material sales. These day-count conventions approximate a smooth annual flow; they provide no monthly liquidity profile or within-year payment calendar.

Supplier payables equal 30/365 of variable operating costs, including inbound logistics, processing, residue handling and outbound freight. Fixed overhead is paid during its operating year. Normal operating stock and prepayments equal 15/365 of processing cost. The USD 0.15 million closing stock/prepayment funding is the initial working-capital asset; excess relative to the first operating year's normal stock requirement is released through the same cash-flow identity. There is no separate cash reserve counted as revenue.

Cash receipts equal collectible revenue plus opening receivables less closing receivables. Supplier cash payments equal accrued variable costs plus opening payables less closing payables. Operating cash flow also deducts fixed overhead and the change in stock/prepayments. The resulting identity is operating cash flow equals EBITDA less the change in net working capital. Free cash flow then deducts maintenance capital expenditure, ramp capital expenditure and integration spending. Loan proceeds and debt service are excluded from this unlevered measure.

The first-year base case earns USD 1.433 million in gross fees and receives USD 0.943 million of fee cash. Normal net working capital reaches USD 0.559 million, a USD 0.409 million increase from closing funding. EBITDA is USD 0.619 million. Operating cash flow is USD 0.210 million;

required maintenance, ramp and integration expenditures reduce unlevered free cash flow to negative USD 1.020 million.

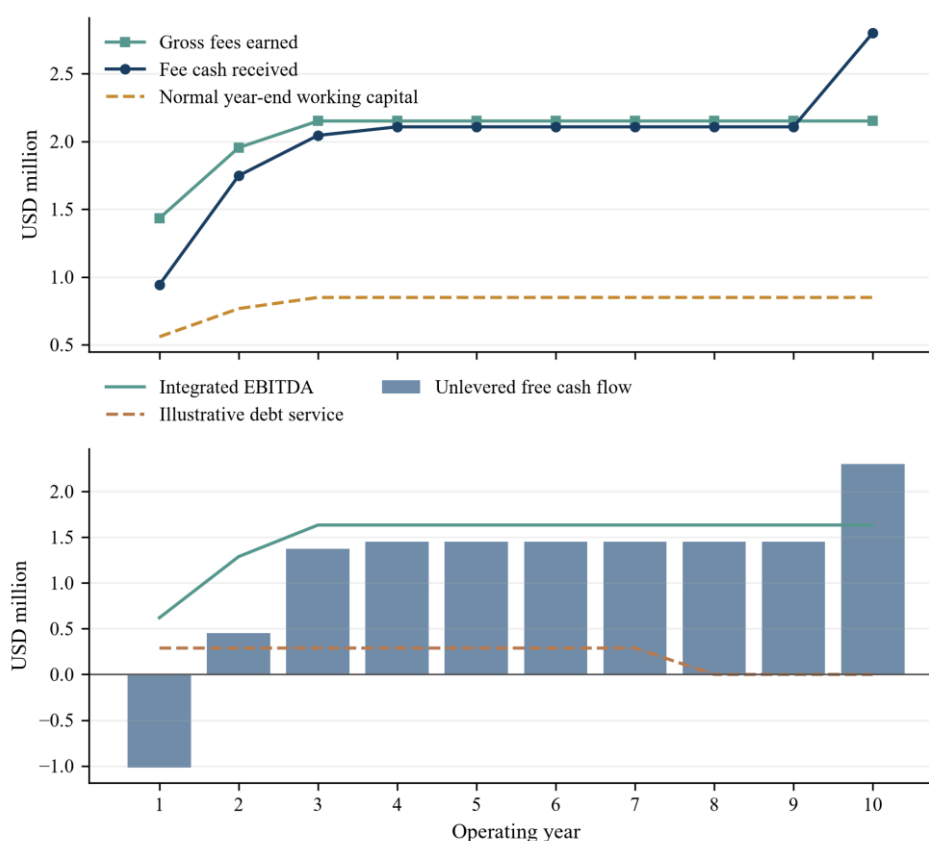
At the mature integrated operating level, normal working capital is USD 0.849 million. Year ten releases that balance in the model's finite-horizon closure convention. The resulting increase in receipts is a collection and balance-sheet unwinding effect. Continued operations beyond year ten would require continuing working-capital funding. A buyer using a going-concern terminal value would need to replace this closure convention and avoid adding the same working capital again.

Table 8. Integrated earnings, cash conversion and debt diagnostic

Year	Gross fees USD m	Fee cash USD m	Normal NWC USD m	EBITDA USD m	FCFF USD m	Debt service USD m	DSCR
1	1.433	0.943	0.559	0.619	-1.020	0.288	-3.539
2	1.955	1.748	0.767	1.288	0.450	0.288	1.563
3	2.151	2.045	0.849	1.633	1.371	0.288	4.758
4	2.151	2.108	0.849	1.633	1.453	0.288	5.043
5	2.151	2.108	0.849	1.633	1.453	0.288	5.043
6	2.151	2.108	0.849	1.633	1.453	0.288	5.043
7	2.151	2.108	0.849	1.633	1.453	0.288	5.043
8	2.151	2.108	0.849	1.633	1.453	0.000	N/A
9	2.151	2.108	0.849	1.633	1.453	0.000	N/A
10	2.151	2.801	0.849	1.633	2.302	0.000	N/A

FCFF deducts maintenance, ramp capex, integration cash spend and changes in working capital. Year ten releases receivables and operating stock at carrying value and settles payables. No plant salvage or continuing-business value is included.

Figure 3. Fictional fees, working capital and free cash flow



Fee cash follows a 120-day receivable convention and a 2% collection loss. Year ten collects closing receivables, releases operating stock and settles payables; no continuing business value is added.

11. Integration value follows a timed, costed bridge

Buyer P receives three fictional operating benefits: USD 8 lower collection cost per collected screened tonne, USD 180,000 lower annual shared fixed overhead and a USD 6 quality/offtake premium per accepted tonne. The premium changes receipts while leaving physical recovery and saleable output unchanged. Its economic meaning is an assumed improvement in realized customer pricing after the specified documentation and quality arrangements. It supplies no evidence of a technically superior separation process.

Each benefit is absent in year one, reaches 50% in year two and reaches 100% from year three. Full-phase annual gross benefit is USD 278,088 at base accepted volume. Integration cash spending is USD 350,000 at closing, USD 250,000 in year one and USD 150,000 in year two. Collection savings apply to the collected share only. Shared overhead savings reduce fixed operating cost. The quality premium enters material sales and therefore also affects material receivables.

At the 12% unlevered discount rate, standalone enterprise value is USD 3.806 million and integrated enterprise value is USD 4.318 million. The USD 0.511 million net increment incorporates benefit timing, the integration outlays and working-capital consequences. The bridge separately displays route savings, fixed savings, quality pricing, integration cost and the residual receivable/payable timing effect. Annual full-phase benefit multiplied by ten would ignore the delayed start and discounting.

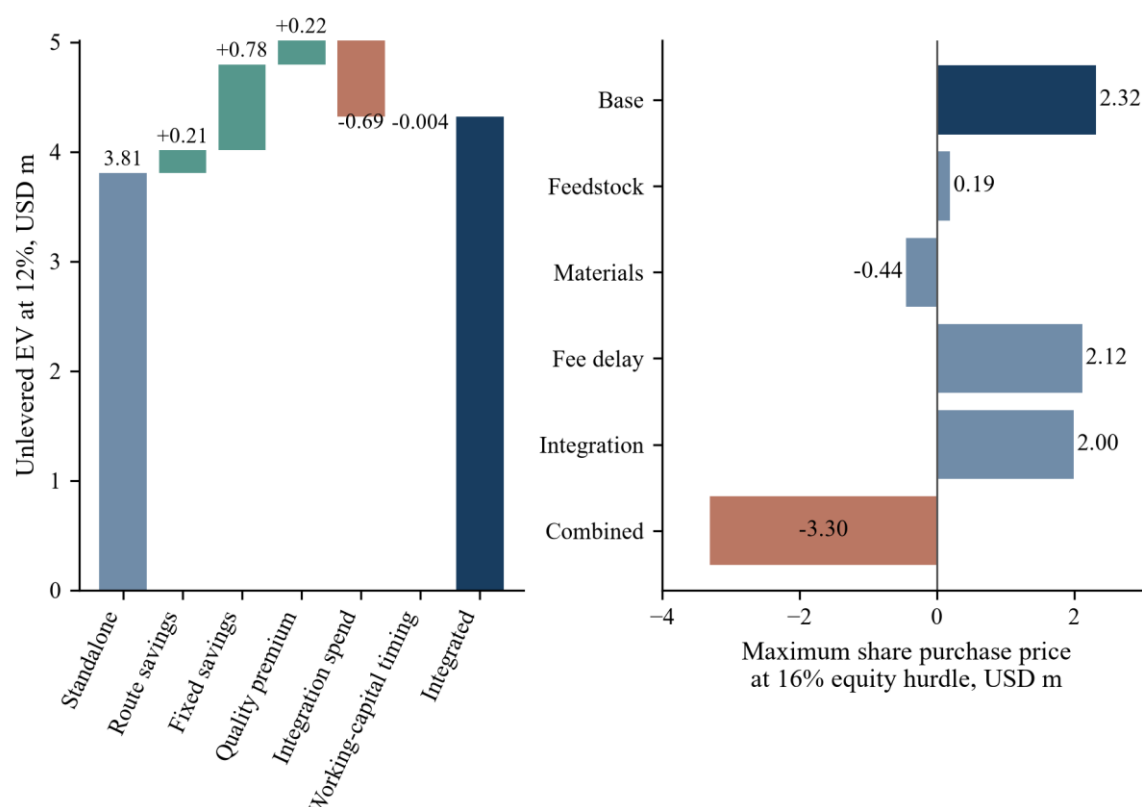
No volume synergy, capacity expansion, acquisition multiple, disposal-fee saving, recovered-mass improvement or specialist ownership benefit is included. In a transaction process, each proposed extension would require its own changed input and costed mechanism. The integration-delay scenario tests later benefits and additional spending explicitly, allowing the price consequence to be compared with the base bridge.

Table 9. Fictional integration timing and acquisition boundaries

Item	Assumption
Collection cost saving	8 USD per collected screened tonne at full phase
Shared fixed overhead saving	180,000 USD per year at full phase
Quality/offtake premium	6 USD per accepted tonne at full phase; no extra physical yield
Synergy timing	0% year one; 50% year two; 100% years three to ten
Integration cash costs	350,000 USD close; 250,000 year one; 150,000 year two
Unlevered discount / fixed equity hurdle	12% / 16%
Target debt retired / new loan	1.20 / 1.50 USD million at close
New debt	8%; seven equal annual payments from year one
Illustrative offer EV / share price	4.00 / 2.80 USD million; zero surplus target cash

Enterprise value buys operating assets subject to the debt-free/cash-free bridge. Target debt retirement is included once in total acquisition uses. New debt is a financing source, with principal and interest deducted only in equity cash flow.

Figure 4. Fictional integration bridge and acquisition price ceilings



The value bridge includes timed synergies, integration spend and working-capital effects at a 12% unlevered rate. Share-price ceilings use a separate 16% equity hurdle and the explicit debt bridge.

12. The purchase-price ceiling follows an explicit equity bridge

The fictional target has USD 1.20 million of debt retired at closing and zero surplus cash. Enterprise purchase price therefore equals share purchase price plus that debt retirement. Buyer P draws a new USD 1.50 million acquisition loan at closing, with 8% interest and seven equal annual payments beginning in year one. Annual debt service is USD 288,109. The existing debt retirement is a transaction use once; the new loan is a source once. Interest and principal reduce future equity cash flow, with no tax shield.

The price ceiling fixes an equity hurdle of 16%. Maximum enterprise purchase price equals new debt drawn plus the discounted value of future equity cash flows, less closing ramp capital expenditure, initial working capital and closing integration spend. Future equity cash flow equals unlevered free cash flow less scheduled debt service. Annual negative equity cash flows remain negative in this calculation. Maximum share purchase price then deducts the target debt retirement from the enterprise ceiling.

These assumptions produce a maximum enterprise purchase price of USD 3.522 million and maximum share purchase price of USD 2.322 million. The separate USD 4.00 million illustrative enterprise offer requires USD 2.80 million paid for shares and USD 3.60 million initial buyer equity after all closing uses and new debt. Its equity NPV at the 16% hurdle is negative USD 0.478 million. The 12% integrated unlevered value and the 16% equity price ceiling answer different specified discount-rate and financing calculations. Adding them would duplicate operating cash flows.

The immediate repayment schedule also exposes funding pressure. Debt-service coverage ratio (DSCR) is defined here as model-specific free cash flow after all required operating, capital and integration expenditure and changes in net working capital, divided by scheduled debt service. This definition and the 1.25 threshold are author-selected diagnostic conventions; they establish no lender standard. The base case's deepest cumulative post-closing equity deficit is USD 1.308 million, additional to initial acquisition equity. First-year cash after all required expenditure is negative; its DSCR diagnostic is negative 3.54. Year-three coverage reaches 4.76. A diagnostic requiring at least 1.25 coverage in every loan year supports zero immediately amortizing debt under this cash-flow convention. The modelled loan therefore requires separate committed equity liquidity or a separately tested financing structure. No refinancing, payment holiday or additional borrowing is assumed.

Table 10. Acquisition value and price ceiling reconciliation

Metric	USD million
Standalone unlevered EV at 12%	3.806
Integrated unlevered EV at 12%	4.318
Net integration value at 12%	0.511
Maximum EV at 16% equity hurdle	3.522
Less target debt retired at close	-1.200
Maximum share purchase price	2.322
Initial equity at illustrative offer	3.600
Equity NPV at illustrative offer	-0.478
Extra equity liquidity after close	1.308

The ceiling solves equity NPV = 0 at the specified hurdle using explicit annual equity cash flows. A separate standalone DCF must not be added to this price ceiling.

13. The scenarios locate distinct failure points

Six deterministic cases retain a common acquisition perimeter. The feedstock-constraint case reduces contract realization to 70% and uncontracted capture to 8%, producing 6,210 eligible annual tonnes. Integrated unlevered enterprise value falls to USD 1.717 million and the maximum share price to USD 0.193 million. Year-one throughput remains capacity-constrained at the base level; the reduced supply becomes consequential during later ramp years. This timing explains the unchanged first-year DSCR alongside a much lower acquisition ceiling.

The material-price case reduces every raw material quotation by 30%, with unchanged saleable mass, offtake factors and outbound costs. Its integrated enterprise value is USD 1.043 million and the algebraic maximum share price is negative USD 0.444 million. Fixed outbound cost means product netback declines by a different percentage from the quotation. The slow-fee-collection case extends fee receivables from 120 to 180 days, with unchanged earned fees and permanent collection loss. Its enterprise value is USD 4.134 million; required additional post-closing equity liquidity rises to USD 1.539 million.

The integration-delay case moves the benefit phases to zero, zero, 50% and then 100%, while integration spending becomes USD 250,000, USD 250,000 and USD 100,000 in years one through three after the unchanged closing cost. Its maximum share price falls to USD 1.996 million. The combined downside applies lower feedstock realization and capture, 85% intake acceptance, a 30% material quotation reduction, 30% higher inbound collection cost, 180-day fee receivables, slower capacity ramp and delayed synergy phases. Its enterprise value is negative USD 2.337 million and additional equity liquidity reaches USD 3.670 million. Negative algebraic

purchase ceilings describe insufficiency of the assumed cash flows for the specified obligations; they propose no negative-price transaction.

The threshold maps vary eligible supply and processing tipping fees while retaining every other base assumption. At base supply, the processing fee required to support the illustrative enterprise offer at the equity hurdle is USD 223.51 per accepted tonne, compared with the assumed USD 210. At 80% of base eligible supply, that threshold rises to USD 279.80. The year-three 1.25 DSCR fee threshold at base supply is USD 83.69; first-year funding remains a separate test. These are arithmetic boundaries within the chosen assumptions, with no estimated likelihood of achievement.

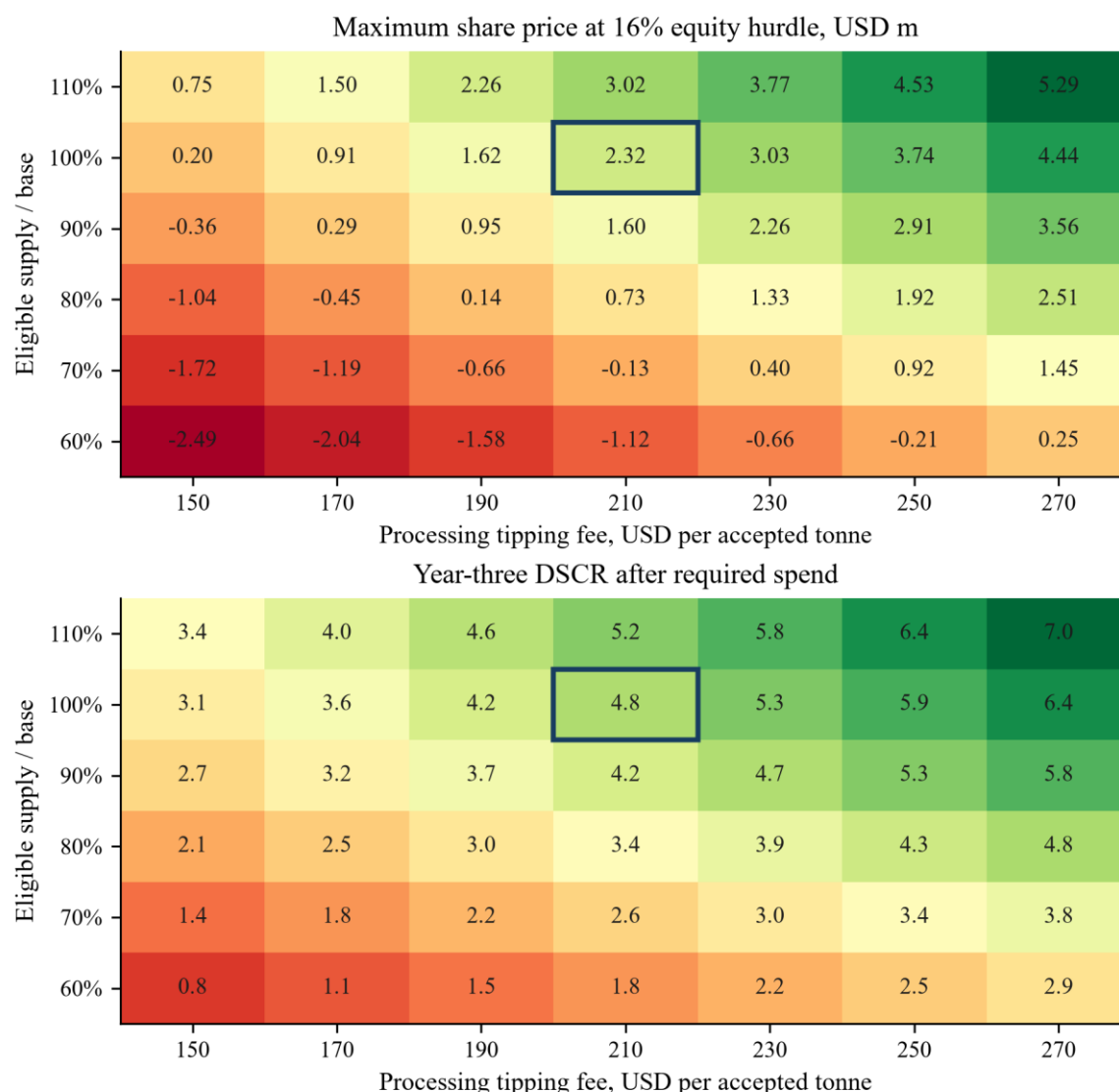
The model's arithmetic reconciliations cover composition totals, saleable mass plus residue, screening conservation, capacity and supply limits, fee recognition, netbacks, operating cash conversion, capital deductions, debt amortization and the enterprise-to-equity price bridge. These identities define the consistency checks within the fictional worked case. They provide no independent assurance of the inputs, counterparties, permits, process design or eventual acquisition outcome.

Table 11. Scenario valuation and liquidity results

Case	Steady accepted t	Unlevered EV USD m	Max EV at equity hurdle USD m	Max share price USD m	Year-one DSCR	Year-three DSCR	Extra equity liquidity USD m
Base	8,418	4.318	3.522	2.322	-3.539	4.758	1.308
Feedstock constraint	6,210	1.717	1.393	0.193	-3.539	2.934	1.387
Material price decline	8,418	1.043	0.756	-0.444	-4.813	2.603	2.064
Slow fee collection	8,418	4.134	3.319	2.119	-4.341	4.649	1.539
Integration delay	8,418	3.961	3.196	1.996	-3.539	3.930	1.375
Combined downside	5,737.500	-2.337	-2.105	-3.305	-6.100	0.182	3.670

No scenario probability is assigned. Extra equity liquidity is the deepest cumulative future equity-cash deficit after close; it is separate from initial acquisition equity. A negative maximum price is an algebraic affordability result, not a proposed negative-price transaction.

Figure 5. Fictional acquisition-price and debt-coverage thresholds



Cell values change only processing tipping fees and eligible feedstock supply. The outlined cell is the base case. Year-three coverage does not resolve the modelled first-year funding deficit.

14. Build the acquisition perimeter around an accountable service

Buyer P should describe the purchased service from collection instruction through accepted preprocessing and documented downstream delivery. The perimeter schedule should identify vehicles or transport contracts, collection equipment, the operating site, plant, leases, employees, operating records, software access and customer relationships required for that service. Each item needs an owner, transfer mechanism, completion condition and fallback. A headline description such as “integrated recycling platform” provides insufficient detail for this schedule.

The make/buy/partner decision belongs beside that perimeter. Acquisition would bring the nominated collection and preprocessing assets under Buyer P's operating control. Specialist treatment should remain a purchased service until a separately evidenced investment case supports ownership. Transport could combine acquired routes with qualified subcontractors, subject to route-level costing and service accountability. The model should therefore carry the specialist toll and collection logistics explicitly. Procurement savings require a named contractual or operational action before entering the acquisition case.

Fictional decision progression, stage one: Buyer P screens Target R as a collection/preprocessing hub and asks whether every proposed revenue line has a deliverable service, supporting contract and accountable operator. The buyer excludes hypothetical specialist-treatment assets from the purchase valuation. It also asks the seller to identify any group-owned equipment, dispatch systems or shared staff needed to operate the hub independently. Unresolved dependencies become separation requirements and potential completion conditions.

Property access, utilities, maintenance cover, consumables and spare-parts availability belong in this exercise. A usable machine without access to its control software or an assignable maintenance arrangement could create an operating dependency requiring a priced remedy. The diligence team should test that dependency through demonstrations, licence review and supplier confirmation.

The result is a service-boundary drawing and a responsibility register. Each custody transfer should state who schedules transport, weighs material, records exceptions, authorizes acceptance and bears the proposed cost of rejection. This creates a practical basis for assessing the purchase perimeter and the outside processor's service agreement together.

15. Separate purchase structure, legacy exposure and required consents

An asset-purchase proposal should specify the assets, contracts, inventories, records and obligations intended for transfer. A share-purchase proposal should identify the entity being acquired and every retained or transferred group dependency. Buyer P should obtain jurisdiction-specific advice on the exposure associated with each structure, including environmental conditions, historical operations, employee matters and applicable approval requirements. The commercial decision should use that advice and its costed consequences.

The legacy review should distinguish site conditions, stored material, historical shipments, prior customer certificates and claims attached to products sold. For each category, the adviser should record the evidence examined, unresolved questions, potentially responsible counterparties and available recourse. The buyer needs original records and relevant correspondence; a certificate register alone gives an incomplete diligence package. Certificate review should distinguish issued documents, supporting weight records, named recipients, processing evidence and contractual promises.

Product-claim review should identify representations about recovered content, treatment completion, material quality and intended use, together with supporting batch records and customer terms. Counsel and technical advisers should evaluate the representations and define any proposed corrective action, disclosure or contractual protection.

Counsel should review proposed warranties, specific indemnities, disclosure schedules and escrow arrangements against identified risks. The negotiated package should describe claim procedures, access to records, investigation cooperation and the relationship between remediation obligations and operating control. A proposed contractual exclusion requires advice on the exposure that remains after completion. Buyer P should also examine the seller's capacity to satisfy recourse and the proposed security supporting it.

Consent diligence should cover customer and supplier contracts, property arrangements, finance documents, software licences and relevant operating approvals. The register should distinguish assignment, change-of-control, novation, notification and renewal questions for advisers to

resolve. Each critical dependency needs evidence of its required treatment before the buyer declares operational readiness.

Fictional decision progression, stage two: Buyer P makes its choice of purchase structure conditional on the legacy review and consent register. An unresolved historical certificate claim is assigned a dedicated diligence workstream. A critical specialist-processing agreement receives a separate completion gate. Buyer P can then revise the acquired perimeter, negotiate specific protection, defer completion or withdraw in accordance with its agreed transaction process. None of these illustrative choices establishes the applicable legal outcome.

16. Convert diligence findings into price and completion mechanics

The investment committee should receive a risk-to-price bridge with traceable evidence. Each adjustment needs a finding, financial treatment, owner and release condition. The bridge should distinguish recurring operating economics, one-off separation expenditure, working capital and contingent exposure. Putting all four into a single discount would obscure the assumptions that the buyer must subsequently test.

Table 12. Proposed diligence-to-price mapping

Diligence issue	Valuation treatment to test	Transaction mechanism	Evidence gate
Feedstock supported only by nominations	Revise accepted-tonne case	Contract condition or price revision	Executed delivery terms
Unpriced specialist rejection	Add disposal, freight and toll scenario	Service agreement and defined recourse	Acceptance protocol and priced schedule
Shared group systems	Add separation cash requirement	Transition agreement and funded plan	Standalone operating test
Historical site or certificate exposure	Separate contingent-risk assessment	Adviser-led protection and security	Specialist report and negotiated allocation

Notes: These are proposed treatments for diligence scenarios. No row represents an observed Target R finding or an assessed liability.

Buyer P should reconcile plant records, invoices, credit notes and bank receipts over the same observation period. It should examine whether reported tonnes include rejected loads, repeat weighings, transferred inventory or material awaiting processing. Reported revenue needs a bridge to the underlying service and cash collection. Any correction should flow into the companion model's accepted-volume, unit-cost, netback or working-capital assumptions with an explanation.

The completion statement should define inventory categories and measurement dates. Unprocessed incoming material, intermediate fractions, accepted saleable outputs and rejected residues warrant separate quantities and proposed values. Ownership, related customer fees, unpaid processing costs and downstream obligations should be reconciled for each category. The buyer should avoid paying for inventory whose proposed recovery value already appears elsewhere in the price calculation.

Fictional decision progression, stage three: Buyer P tests a scenario involving incomplete downstream acceptance evidence and a shared dispatch dependency. It requests the missing evidence and estimates any separation work through supplier quotations. The companion model's purchase-price output remains subject to those evidence gates. Release of a holdback would require the negotiated deliverable; an operating dependency would receive a funded separation

task. Each price deduction should identify its distinct economic basis and any interaction with other adjustments.

17. Match feedstock promises with downstream acceptance

Feedstock contracting should define the material that Target R agrees to accept and the service it agrees to perform. The schedule should distinguish nominations, booked deliveries and any enforceable delivery commitments established by counsel. Commercial diligence should test counterparty authority, cancellation rights, termination provisions and the process for changing specifications. Forecast nominations should retain their separately identified realization assumption in the model.

Table 13. Proposed matched contract terms

Interface	Feedstock-side term	Downstream-side term	Reconciliation test
Identity	Origin and declared module category	Permitted fraction description	Load-to-output mapping
Quantity	Agreed acceptance weighing	Agreed dispatch and receipt weighing	Documented mass bridge
Quality	Contamination and damage schedule	Sampling and acceptance specification	Comparable sampling record
Rejection	Notice, custody and cost allocation	Retest, return and alternate-route terms	Named cost bearer
Payment	Defined fee-earning event	Netback, deductions and settlement date	Invoice-to-cash bridge

Notes: The parties would negotiate specifications, tolerances and remedies using technical evidence. This table supplies a term-design framework without assumed thresholds or prevailing market terms.

The incoming agreement should identify packaging, collection access, loading responsibilities, transport booking, document requirements and procedures for damaged or unidentified material. The buyer should request evidence for representations about origin and ownership. Acceptance should have a recorded decision, timestamp and reason code. Any preliminary acceptance pending inspection should state the next decision point and proposed custody arrangement.

The fictional model makes collection and preprocessing fees conditional on accepted/preprocessed tonnes. Operational contracts and billing rules should use the same defined eligible quantity, while keeping collection logistics and plant processing costs separately measurable. Buyer P should check which costs arise before acceptance and how rejected material affects the commercial result. An apparently attractive fee can require a different price when collection attempts, storage or rejection handling remain uncompensated.

Offtake agreements should define output specifications, sampling responsibility, weight determination, settlement calculations and deductions. Specialist tolling needs a matching input specification, scheduling process, rejection procedure and treatment-evidence package. Proposed alternate outlets require documented qualification and commercial terms before they support the downside case. Claimed output value should remain conditional on the contracted buyer's acceptance and settlement basis.

Fictional decision progression, stage four: Buyer P negotiates aligned incoming and downstream acceptance schedules before crediting the model's quality-netback synergy. It tests a rejection scenario through the proposed freight, storage, retesting and settlement provisions. The committee receives the resulting cost allocation and model sensitivity, with unresolved commercial terms separately identified.

18. Make contingent consideration auditable through cash

An earn-out should reward a defined contribution that Buyer P can verify. Proposed measures should follow accepted loads through processing, invoicing and collection. Rated equipment capacity and unsigned nominations should remain outside the earned-payment calculation. The agreement should define the measurement period, eligible business, permitted adjustments, accounting policies and treatment of related-party transactions before signing.

Table 14. Proposed earn-out evidence ladder

Measure	Proposed evidence	Adjustment requiring definition	Payment control
Eligible accepted tonnes	Load record and completed preprocessing	Returns and duplicate entries	Approved reconciliation
Contribution margin	Eligible fees less agreed attributable costs	Toll, rejection and logistics charges	Consistent cost schedule
Collected cash	Invoice allocation and bank receipt	Credits, disputes and refunds	Defined collection cut-off
Quality of earnings	Linked underlying records	Intercompany transfers and exceptional items	Independent review rights

Notes: No earn-out rate, threshold or payment amount is proposed here. The companion model supplies the illustrative acquisition economics.

The drafting team should address how Buyer P's operating decisions affect measurement. Integration could change routes, overhead allocation, transfer pricing or customer billing entities. Each adjustment needs an agreed method and a record accessible to both sides. Any permitted operating covenants should preserve a workable integration plan while defining the seller's legitimate measurement protections through counsel.

Fictional decision progression, stage five: Target R's seller receives a proposed contingent component tied to eligible contribution and collected cash. Buyer P requires a reconciled load population and expressly defined costs before calculating it. Historical remediation protections sit in a separate schedule with their own release tests. The investment committee considers contingent consideration alongside the companion model's maximum-price output, financing needs and cash headroom.

A dispute procedure should specify data access, reconciliation deadlines, expert appointment and treatment of undisputed amounts. Refunds or late credits discovered after a measurement period require a negotiated adjustment rule. The resulting calculation should be reproducible from archived operational and accounting records.

19. Use the first hundred days to establish one custody-to-cash chain

The integration plan should begin with continuity and evidence preservation. Buyer P should identify the people authorized to accept loads, approve supplier charges, issue certificates and release customer credits. Dispatch, weighbridge, processing, stock control and finance should share a stable load identifier, with controlled links to module serial records where available. Missing serials should retain a documented status; reconstruction should never silently create source records.

Table 15. Proposed hundred-day integration gates

Window	Operating gate	Required evidence	Accountable function
Days 0-10	Custody and billing continuity	Access checks, opening stock and exception log	Site lead and finance

Window	Operating gate	Required evidence	Accountable function
Days 11-30	One load-to-invoice bridge	Weights, processing events and credits reconciled	Operations controller
Days 31-60	Standalone systems and contracts	Separation tests and consent evidence	Integration lead
Days 61-100	Synergy and assurance review	Cash-linked savings and sample audit	Investment sponsor

Notes: The windows define an illustrative work sequence whose duration requires transaction-specific assessment.

The proposed event chain is collection instruction, arrival, gross and tare weighing, inspection, acceptance decision, processing batch, output dispatch, downstream receipt, invoice and cash allocation. Splitting or combining loads requires parent-child links. Reweighings need retained originals and reasons. Mass-balance reconciliation should include opening inventory, incoming mass, outputs, recorded residues and closing inventory, using agreed measurement conventions and documented uncertainty. Exceptions require investigation and approval.

Separation work should cover access permissions, payroll, maintenance records, supplier accounts, utility billing, software licences and historical archive ownership. A transition-services agreement should identify services, charges, milestones, service evidence and exit arrangements. Buyer P should test the standalone operating sequence before removing a dependency. Any unresolved dependency should remain visible in the investment committee's cash and continuity assessment.

Synergy validation should follow the model's categories. Collection-route savings require comparable route and cost evidence. Shared-overhead savings require identifiable released expenditure and retained-service costs. Quality-netback improvements require comparable acceptance and settlement evidence. The illustration credits no acquisition-driven volume uplift. The hundred-day review should report realized cash effects, implementation costs and remaining assumptions separately.

20. Govern the data so the platform can withstand an exit audit

Buyer P should retain an evidence dictionary defining loads, accepted tonnes, processing completion, fractions, certificates, eligible fees and collected cash. Each field needs a system owner, source, amendment authority and retention decision reviewed for applicable requirements. Access should follow assigned responsibilities. Corrections should preserve the original entry, author, time and reason, including manual spreadsheet adjustments used during separation.

Buyer P should test a proposed exception-matching control linking load identifiers, weights, processing and certificate records, invoices and cash allocations. Validation should use reconciled records and known exception cases to assess missed links, duplicate matches and false alerts before operational use. Named authorized people should retain authority for intake acceptance, certificate issuance, claims resolution, accounting entries and earn-out approval. Access, retention and permitted sharing of transaction and personal data should follow an approved handling arrangement reviewed for applicable privacy and confidentiality requirements. Unresolved matches should preserve the original records and enter a documented human-review queue.

The exit data room should develop alongside operations. Its index should connect acquired-asset records, consent evidence, environmental reviews, customer contracts, specialist-processing agreements, load histories, certificates, stock reconciliations and cash settlement. The buyer should maintain the chain between headline financial measures and sample underlying

transactions. An independent reviewer should be able to select a load and trace its commercial and physical record in both directions.

Fictional decision progression, final stage: Buyer P releases integration gates only when the agreed evidence is available. Its exit narrative then distinguishes acquired capability, contracted specialist capacity, realized savings and outstanding exposure. An unresolved certificate or inventory exception remains an identified diligence item with an owner and cost assessment. The platform's investment case is updated from those records, preserving the boundary between the companion model's illustrative assumptions and verified post-acquisition evidence.

21. Test the acquisition against a deliverable alternative

An acquisition recommendation should compare the proposed purchase with an executable alternative for the same service boundary. For the illustrative buyer, that boundary is collection and preprocessing, with specialist treatment purchased from an outside processor. The alternative could be a contracted collection network using an existing qualified hub. A greenfield proposal would require its own evidence for site access, permits, equipment, staffing and commissioning. Each alternative needs a comparable cash-flow period and a defined treatment of residual obligations.

The comparison should retain costs that change with ownership. A purchased hub may bring transferable customer relationships and operating records, together with refurbishment requirements, separation expenditure or historical exposures requiring specialist assessment. An outsourced arrangement may carry a different fee, acceptance protocol, service capacity and renewal dependency. The financial comparison should incorporate those differences where evidence permits measurement. Unresolved exposures should remain separately visible in the recommendation and transaction conditions.

The buyer should specify the evidence needed to reopen the decision. A processor's refusal to accept a proposed fraction could change the deliverable service and its cost. Loss of a nominated collection contract could change accepted throughput. A requirement for additional storage or environmental work could change initial funding and the timing of operations. These questions belong in the comparison before an acquisition price is agreed.

The outsourced and greenfield alternatives remain unevaluated comparison cases in this paper; their cash flows have not been quantified. The proposed comparison identifies the capability, economics and recourse the buyer would obtain for the additional capital. In an actual transaction, the investment committee would need binding commercial terms, technical diligence and appropriately scoped legal and environmental advice before accepting a comparison and selecting its preferred ownership structure.

22. Connect the analytical results to an investment committee decision

The recycling model in this paper is a worked illustration using author-selected inputs. It demonstrates how accepted feedstock, saleable fractions, service fees, costs, capital expenditure and cash timing interact. An actual recommendation would replace those inputs with transaction evidence. The model's purchase-price ceiling is a conditional calculation for its stated cash-flow boundary and required return. It does not establish an observed enterprise value, an executable offer or a lender commitment.

The investment committee should receive a reconciliation from the seller's reported revenue to eligible services and material sales. The corresponding cost bridge should identify collection, preprocessing, specialist treatment, rejected material, overhead and sustaining expenditure. Working capital should be supported by customer and supplier terms, inventory records and subsequent settlements. A volume forecast needs accepted delivery evidence and a defined treatment of cancellations, contamination and load rejection.

Each proposed acquisition benefit requires its own counterfactual. Route savings should compare the same collection service, payload and destination before and after the proposed change. Overhead savings should identify expenditure that can actually be released and any replacement cost. A better recovered-material netback requires accepted product specifications, payable quantities and contractual settlements. The buyer should remove any benefit already included in standalone operating assumptions before adding the remaining acquisition effect to value.

The proposed transaction structure should respond to the unresolved evidence. A price condition can address an unconfirmed cost or volume assumption. A staged payment can link consideration to a negotiated operating milestone. A separately advised protection can address a defined historical exposure. Each mechanism has commercial and legal limitations requiring transaction-specific review. The model remains a decision aid whose inputs, cash timing and boundaries must remain visible through those negotiations.

For Buyer P's worked case, an offered enterprise value of USD 4.000 million produces an equity net present value of approximately negative USD 0.478 million at the assumed 16% equity hurdle. The model's conditional enterprise-price ceiling is USD 3.522 million, equivalent to a USD 2.322 million share price after the assumed USD 1.200 million target-debt retirement. These figures retain the model's stated acquisition-debt, cash-flow and closing-cost conventions. They should be read alongside the separate USD 4.318 million integrated enterprise value calculated at the 12% unlevered rate; the two rates answer different analytical questions.

The illustrated funding plan also requires approximately USD 1.308 million of first-year cash above closing equity. Immediate seven-year annuity debt of USD 1.500 million fails the model's all-year coverage diagnostic. Buyer P's illustrated acquisition therefore needs both a price revision or changed return assumption and a separately funded ramp-up plan before it satisfies those analytical tests. A lower purchase price alone leaves the operating ramp-up requirement in place. Any revised financing structure would require a fresh cash schedule and transaction-specific lender assessment.

23. State the limits of the research and the worked case

The public sources describe regulations, technology, operating approaches and selected issuer policies. They do not establish the economics of the illustrative hub. Country surveys may combine different observation dates, module technologies and reporting practices. Historical recycling cost observations require their original date, geography and service boundary. An issuer's disclosed revenue-recognition policy does not demonstrate another operator's margin, collection performance or customer recourse.

The worked case deliberately omits a universal market forecast. Installed photovoltaic capacity alone does not provide the contracted, legally acceptable and logistically deliverable tonnes required by a particular site. Retirement timing, access to owners, module condition, permitted

processes and downstream acceptance require separate evidence. No probability is attached to the illustrative scenarios. They are parameter tests whose relevance depends on the transaction being considered.

The process representation also has a defined limit. Its assumed fractions and acceptance rates are accounting inputs for a material-and-cash illustration. They do not certify engineering performance or the suitability of a treatment process. Representative sampling, calibrated measurement, trials and qualified buyer acceptance would be required to substantiate actual yields and saleable output. Any environmental benefit would need its own lifecycle boundary and evidence; the acquisition model does not quantify avoided emissions or sustainability certification.

Further research should examine matched operational and financial records across module cohorts and treatment routes. A useful empirical dataset would connect arrival condition and composition to processing time, accepted output, residue, settlement and claims. Such a dataset could test the explanatory value of the proposed framework. The present paper provides an acquisition diligence and capital-allocation method with an explicit worked illustration. It does not claim an observed transaction outcome or an empirically validated return.

Frequently Asked Questions

What does a solar-recycling platform buyer actually acquire?

The agreed perimeter may include collection contracts, intake capability, preprocessing equipment, site rights and operating records. Each right and obligation needs its own transfer and consent assessment. In the worked case, specialist treatment remains outside the acquisition and is purchased under a separate contract.

Can installed solar capacity establish a target's feedstock?

Installed capacity supplies context for retirement scenarios. A particular target needs evidence of accessible owners, delivery commitments, module condition, permitted acceptance and logistics. The worked case separately states nominated supply, realization, capture and acceptance assumptions.

How should recovered material enter the valuation?

The model applies composition, process recovery and saleable acceptance separately. Material revenue follows accepted output and an assumed offtake price; transport and other costs remain explicit. Actual yields and settlements require technical and commercial evidence.

Does producer responsibility assure payment to the acquired hub?

The relevant legal framework and contract determine the responsible party and service scope. The buyer must verify applicable national rules, counterparties, billing events and recourse. The cited European and US materials do not establish an automatic payment entitlement for the fictional target.

Why does the price ceiling differ from integrated enterprise value?

Integrated enterprise value discounts unlevered operating cash flows at 12%. The conditional price ceiling uses a 16% equity hurdle, closing uses and specified acquisition debt. Its assumed loan fails the all-year coverage test, so the ceiling requires a separately funded ramp-up or a newly tested financing structure before use in a transaction.

What should the first hundred days establish?

The proposed sequence establishes custody records, intake decisions, matched processing and settlement evidence, and a reconciled cash cycle. It assigns operating dependencies and costed integration tasks to accountable owners. Timing and scope require transaction-specific assessment.

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About the Author

Chennakeshav (CK) is a corporate finance and investment banking executive with 25+ years of global experience in deal origination, structuring and execution across M&A, growth capital and corporate strategy. He has led value-creation mandates for founders, corporates and funds — bridging the boardroom view to hands-on execution and close.

His career spans Morgan Stanley, HSBC, Lloyds Banking Group, EWEC, ADQ portfolio companies and Emirates Growth Fund, across TMT, real estate, fintech, deeptech, cleantech, infrastructure and energy. He has partnered with C-suite leaders, private equity and venture funds, sovereign wealth funds and family offices to finance complex fund raises and scale-up ventures, and has led M&A due diligence, post-merger integration and business-transformation initiatives to create value.

At Matchpoint Partners he is Managing Partner, leading the firm's corporate finance, M&A and capital-raising practice. He holds an MBA from London Business School, an engineering degree from VTU and a Master of Laws (LLM, in progress) from UCL London.

An active start-up mentor, CK mentors at Techstars, DIFC FinTech Hive, Startup Grind, Founder Institute and IN5, serves as Entrepreneur Mentor in Residence (EMiR) at London Business School, and judges the Entrepreneurship World Cup.

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