An Analytical Framework for Modification Versus Extinguishment Accounting Under ASC 470-50 in United States Renewable Energy Enterprises

Olabanji John Ogunyemi[1], Faith Ibukun Babalola[2], Emmanuel Chukwuma Okeke[3], Ann Kinyanjui[4]
[1] Independent Researcher, Minneapolis, Minnesota, United States
[2] Independent Researcher, Austin, Texas, United States
[3] Independent Researcher, New York, New York, United States
[4] Independent Researcher, Seattle, Washington, United States
Corresponding author: banjiogunyemi@gmail.com

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Abstract
Purpose. *United States renewable energy companies amend, exchange, repurchase or accelerate their debt far more often than its stated life suggests, and each change must be classified under ASC 470-50 as a modification or an extinguishment. It asks which instruments generate those events, where the boundary with troubled debt restructuring and convertible accounting lies, and what the disclosed events of 2024 to 2025 show.*
Design. *A critical review with framework synthesis reads 252 sources, 122 from the accounting and energy finance journal literature and 130 from an applied corpus on reporting, audit, treasury and risk governance, against the codification and against the terms disclosed by Sunnova, SunPower, XPLR Infrastructure, Altus Power, Sunrun and Plug Power.*
Findings. *The ten percent test, the fee rules, the borrowing capacity test and the troubled debt boundary are restated as six equations and a decision tree, and three worked examples with journal entries show each outcome. Warehouse take-outs, convertible repurchases and new-lender refinancings resolve at the same-creditor node; the conversion option limb and the twelve-month rule decide most of the remainder. Adopted treatments are recorded only where a reviewed filing states them; the classifications offered are the authors' analysis.*
Originality. *To the authors' knowledge no prior study reads ASC 470-50 instrument by instrument for this sector with worked computations and a control map for every input.*

Keywords
ASC 470-50; debt modification; debt extinguishment; troubled debt restructuring; renewable energy finance; covenant compliance; going concern; audit risk

1. Introduction

1.1 The problem and its setting

The debt of a renewable energy company is rarely left alone for the life of the instrument: a construction loan converts to a term loan when the plant is placed in service, a warehouse facility is repaid from a securitization, a convertible note is exchanged or repurchased when the share

price falls, and a portfolio financing carries a buyout obligation the sponsor must refinance. Each event changes the contractual cash flows of a liability, and under United States generally accepted accounting principles each must be classified as a modification or an extinguishment under ASC 470-50, Debt Modifications and Extinguishments. The classification decides whether the old liability stays on the balance sheet at a new effective rate or is replaced with a gain or loss in earnings, and the treatment of lender fees and third-party costs [1], [2].

The question is pressing for three reasons. The cost of debt for renewable energy firms moved sharply between 2021 and 2025, making refinancing and amendment economics central to sponsor returns [3], [4]; the federal tax credit regime changed twice, with the Inflation Reduction Act of 2022 and the reconciliation act of July 4, 2025 [5]; and the residential solar segment produced the largest renewable energy insolvencies in United States history, SunPower Corporation in the District of Delaware on August 5, 2024 and Sunnova Energy International in the Southern District of Texas on June 8, 2025. Companies that did not fail still restructured: XPLR Infrastructure suspended its common distribution on January 28, 2025 to refinance about $2.8 billion of maturities and buyouts, and Plug Power's secured debenture facility of April 28, 2025 retired convertible debenture principal.

Developers, yieldcos, residential solar financiers and independent power producers share a layered capital structure. At the project level sit non-recourse term loans sized to a debt service coverage ratio, tax equity partnerships that exchange a partnership interest for the investment tax credit and depreciation, and, since section 6418 of the Inflation Reduction Act, transfers of tax credits for cash [4], [6]. Above it sit corporate revolvers, convertible and senior notes and, for yieldcos, convertible equity portfolio financings that give an institutional partner a preferred claim on a project portfolio with a sponsor buyout right. Residential solar companies add warehouse facilities that fund customer contracts until a pool can be securitized; Sunrun reported $12.9 billion of non-current non-recourse debt and $472.7 million of convertible senior notes at June 30, 2025. Non-recourse structures isolate project risk and allow higher leverage at a lower cost of debt [7], [8], and that cost has converged with that of fossil fuel firms as rates rose [3].

Each layer is a candidate for modification: project term loans are amended when a plant misses its coverage covenant; warehouse facilities are amended and restated as borrowing base, advance rate and maturity are reset, as Sunnova's agreements of August 22, 2024 and March 20, 2025 were; convertible notes are exchanged, repurchased or settled in shares; portfolio financings are bought out or restructured. Seed studies of capital allocation and treasury practice describe the decision systems within which these amendments are negotiated [9]-[11], and studies of asset liability management and interest rate risk describe the lender side of the same negotiation [12], [13].

1.2 Institutional and regulatory setting

Four pieces of the Accounting Standards Codification govern the events in Table 6. ASC 470-50 applies to all changes in debt terms that are not troubled debt restructurings and contains the ten percent cash flow test, the fee and cost rules, the revolving arrangement rule that originated in Emerging Issues Task Force Issue 98-14, and the rule that an exchange with a new lender is always an extinguishment. ASC 470-60 applies when the debtor is experiencing financial difficulty and the creditor grants a concession it would not otherwise consider; the Financial Accounting Standards Board removed the creditor side of troubled debt restructuring accounting through Accounting Standards Update 2022-02, issued in March 2022, but left the debtor side in place [1], [14]. ASC 470-20, as amended by Accounting Standards Update 2020-06 issued in

August 2020, removed the cash conversion and beneficial conversion feature models so that most convertible notes are now carried as a single liability, which changes what the ten percent test compares when a convertible note is exchanged [15], [16]. ASC 852 governs companies in Chapter 11 from the petition date. Seed studies of regulatory compliance adaptation and SOX compliance frameworks describe the control processes through which these standards are applied [17]-[19], and work on automated close controls and audit analytics shows how the judgement is documented and tested [20], [21]. The interaction with tax credit rules is specific to the sector. The reconciliation act of July 4, 2025 set termination dates for the section 45Y and 48E credits for wind and solar, and Internal Revenue Service Notice 2025-42 of August 15, 2025 changed the beginning-of-construction rules. A project whose credit eligibility changes also changes the cash flows available for debt service, and a lender that reprices or re-amortises in response creates a 470-50 event caused by tax policy rather than credit deterioration. Seed studies of tax governance and of translating finance legislation into strategy describe how companies model such policy shocks [22]-[24].

1.3 Prior literature and the gap

The question sits at the intersection of two literatures that seldom cite each other. The accounting literature has studied debt contracting, covenant renegotiation and covenant violation in depth [25]-[27], and the energy finance literature has studied the cost and structure of renewable energy project debt [7], [8]. Neither addresses the sequence of accounting judgements a renewable energy preparer faces when an instrument is changed. Seed studies on financial reporting models, audit quality and risk governance supply the control environment within which those judgements are made [28]-[30], and studies of predictive financial analytics describe the forecasting systems that generate the cash flow inputs to the test [31], [32].

The wave had common causes: firms with concentrated maturities refinance at unfavourable terms when credit tightens [33], [34], and renewable energy returns are unusually sensitive to the cost of capital because capital expenditure dominates lifetime cost [35]. Seed studies of financial resilience and operational resilience in financial services describe the governance mechanisms that distinguished companies that refinanced in an orderly way from those that did not [36], [37], and seed work on credit risk modelling and loan default prediction describes the lender analytics that priced the amendments [38]-[40]. Neither literature reads the standard from the instruments a renewable energy company actually holds: the covenant literature treats the credit agreement as a generic contract, the energy finance literature treats the accounting as a reporting detail, and practitioner summaries of ASC 470-50 address the generic corporate borrower rather than the warehouse cycle, the tax credit transfer layer, the convertible equity portfolio financing or the construction-to-term conversion [4], [7]. To the authors' knowledge, no prior study combines the paragraph-level mechanics of ASC 470-50 with the instruments of this sector and with its 2024 to 2025 disclosures. The nearest existing models are the renegotiation models of Moraux and Silaghi [41] and Fan [42], which explain why and when debt is restructured but not how the restructuring is classified, and the generic corporate summaries of the standard [4], which classify but do not model the sector's instruments. That is the gap this paper addresses.

1.4 Research questions, contribution and structure

Three research questions follow from the gap. RQ1 asks which debt instruments on United States renewable energy balance sheets generate ASC 470-50 classification events and how the ten percent cash flow test, the fee and third-party cost rules and the borrowing capacity test apply to

each. RQ2 asks where the boundary between ASC 470-50 and troubled debt restructuring under ASC 470-60 falls for these instruments, and how the single-liability model introduced by Accounting Standards Update 2020-06 changes the test for convertible notes. RQ3 asks what the events disclosed between August 2024 and August 2025 by Sunnova, SunPower, XPLR Infrastructure, Altus Power, Sunrun and Plug Power show about the covenant, coverage, going concern and audit consequences of each classification outcome. The contribution is threefold: an instrument-by-instrument reading of the standard expressed as six equations, a decision tree and three worked numerical examples with journal entries; a case set whose transaction terms are drawn from Form 8-K exhibits and quarterly reports rather than secondary reporting, with the accounting treatment recorded where a filing states it and otherwise offered as the authors' analysis; and an audit and internal control map that names the control and the evidence for every input the tests require [26], [43]. The applied corpus on risk governance, financial analytics and audit is used throughout to specify that control environment [29]-[31].

Section 2 sets out the research design, search strategy, screening, coding, framework derivation and validity checks. Section 3 reports the results in the order of the research questions: the mechanics of ASC 470-50 and the framework, the boundary with ASC 470-60, the instruments read through the framework, the verified events, and the consequences for covenants, going concern and audit. Section 4 discusses the findings, relates them to prior work, draws implications and states limitations and a research agenda. Section 5 concludes.

2. Materials and Methods

2.1 Research design

The study is a critical review with framework synthesis. A meta-analysis was not appropriate because the object is a classification rule applied to heterogeneous contracts whose sources (codification paragraphs, credit agreements, filings and an empirical literature with non-commensurable outcomes) offer nothing to pool. Framework synthesis maps the mechanisms found onto the sequence of judgements that ASC 470-50 and ASC 470-60 impose, revising it where the evidence does not fit [25], [27]. The paradigm is positivist: the classification outcome is treated as determinable from observable inputs, and each proposition could be tested against hand-collected disclosure data. The applied corpus was treated as evidence on the control environment rather than on the accounting rule [30], [44], [45]. The first author's project finance experience shaped the choice of instruments and the ordering of the tree but was not used as evidence; every factual claim in Section 3 is attributed to a cited source.

2.2 Search strategy and sources

The review combined four searches: the accounting literature on debt contracting, covenant violation, renegotiation and restructuring; the literature on convertible instruments, fair value of liabilities, going concern reporting and internal control; the renewable energy finance literature on project finance, cost of capital, policy risk and securitization; and a curated seed corpus of applied studies in financial reporting, audit, treasury, risk governance, credit analytics, project governance and energy transition. Table 1 summarises the corpus.

Search strings were built from the terms debt covenant violation, debt renegotiation, troubled debt restructuring, creditor concession, debt modification, extinguishment of debt, convertible debt accounting, earnings per share convertible, fair value option liabilities, own credit risk, going concern opinion, internal control weakness debt contracting, debt maturity rollover risk, renewable energy project finance, cost of capital renewable, solar securitization and third-party

ownership solar, each run against the Crossref index restricted to journal articles with the publication window closed at September 30, 2025 [33], [46]. Inclusion required that a source address debtor-side accounting for a change in debt terms, the contracting behaviour that produces such changes, the measurement of the liability, the audit of the judgement, or the financing structures of United States renewable energy companies; working papers, preprints, conference abstracts, encyclopaedia entries, bank regulatory capital studies and sources dated after September 30, 2025 were excluded. The same relevance criterion was applied to a consolidated set of 273 candidate applied studies [28], [47], [48].

2.3 Screening and corpus

For the journal literature, 170 candidate records were identified from the search strings and backward citation chaining; 126 were retrieved with complete records and screened on title and abstract; 122 met the inclusion criteria, the four removals being two preprints, one sovereign restructuring study without debtor-accounting content and one duplicate. For the applied corpus, 273 candidates were screened against the year gate and relevance criteria; 141 were shortlisted; 130 are cited after removal of duplicates and of eleven studies (healthcare operations, marketing analytics) that bore on no node of the framework. The corpus therefore holds 252 sources. Verified company events were drawn from Form 8-K filings and their exhibits on the Securities and Exchange Commission's EDGAR system; no company fact is asserted unless it appears in a cited filing or exhibit, and secondary press coverage was not used [49]. Table 1 gives the composition of the corpus by strand and the use made of each.

Table 1. Composition of the literature corpus by strand and the use made of each strand.

Strand	Representative sources	Number of works	Use in this paper
Debt contracting, covenants and renegotiation	DeFond and Jiambalvo [25]; Dou [26]; Demerjian and Owens [27]; Wang [50]; Chu [33]	34	Explains why instruments are amended, how lenders price amendments and how maturity structure drives their frequency
Troubled debt restructuring and distress	Pushkin and Pariser [1]; Aksu [2]; Mehmood and De Luca [14]; Ferry [51]	11	Boundary between 470-50 and 470-60; creditor concession
Convertible instruments, earnings per share and fair value	Marquardt and Wiedman [15]; Scott et al. [16]; Barth et al. [52]; Chung et al. [53]	23	Effect of ASU 2020-06 on exchanges of convertible notes
Going concern, audit and internal control	Blay and Geiger [54]; Kim et al. [43]; Costello and Wittenberg-Moerman [55]; seed audit and control studies [18], [29], [44]	20	Consequences of each classification for the audit
Renewable energy finance and policy	Kempa et al. [3]; Srivastava [4]; Firouzi and Meshkani [7]; Comello and Reichelstein [56]; Lazo et al. [46]	34	Why the sector refinances; cost of capital sensitivity
Applied financial analytics, treasury and governance (seed corpus)	[10], [30]-[32], [37]	130	Control environment, forecasting inputs, governance of the judgement

2.4 Data extraction and coding

From each journal source three fields were extracted: the mechanism documented (why an instrument is amended, how an amendment is priced, how an outcome propagates into covenants, earnings or audit opinions), the setting, and the direction of the evidence relative to the framework. From each verified filing six fields were extracted: company, event and date, instruments, disclosure source, the codification paragraph engaged and the key input it requires. Each applied source was coded against one of fourteen themes and the framework node it serves (Section 3.24) [21], [44]. Evidence was weighed by proximity to the question: covenant and renegotiation studies of United States private credit carried the greatest weight [26], [50], [57], sovereign restructuring studies were used only for creditor coordination [51], [58], and the applied corpus for the control, analytics and governance dimensions [30], [45]. Disagreements between sources are reported where they arise.

2.5 Framework derivation and model specification

The framework was derived by reading ASC 470-50 and ASC 470-60 against the instruments identified in the coding and asking which paragraph decides each instrument's classification and what inputs it requires. Each quantitative test was restated as an equation in the notation of Section 3.6: the ten percent test of 40-10 as a present value ratio at the original effective rate, the conversion option limb of 40-10(b) as a fair value ratio against the carrying amount, the extinguishment gain or loss of 40-2 and 40-18, the new effective rate of 40-14 as a present value identity, the borrowing capacity test of 40-21 as a ratio of commitment times term, and the troubled debt measurement of 470-60-35-5 as an undiscounted comparison. The decision tree follows the sequence the standard imposes: troubled debt scope exclusion, creditor identity, the revolving branch, then the quantitative tests. Three worked examples (Sections 3.8 to 3.10) apply Equations (1), (3), (4) and (5) to a hypothetical $50 million seven-year bullet note and a $100 million revolving facility; every parameter is a model assumption, listed in Table 3, chosen inside the coupon, fee and tenor ranges reported for the sector's term debt and warehouse facilities [7], and every number in the text, in Tables 3 and 4 and in Figure 1 is computed by one script from those parameters, so the figure and the text cannot diverge. The sensitivity in Figure 1 computes Equation (1) for the same bullet instrument at original effective rates of 6, 8, 10 and 12 percent across coupon changes of minus four to plus four percentage points and marks the two term-note examples on it. Forecasting and treasury studies in the applied corpus specify the systems that would supply the schedules in practice [31], [59], [60].

2.6 Quality and validity

Three checks address validity: triangulation, in that every company fact rests on a primary filing, every codification claim was read in the paragraph cited, and every empirical proposition rests on at least two journal sources where the literature allows [43], [55]; consistency, in that the corpus counts, the reference list and the citations were reconciled by script; and year gating, in that no source dated after 2025 is cited and no event after September 2025 is described. The method's limits are stated in Section 4.5: the equations do not resolve the judgements inside the standard, the filings seldom report the accounting outcome adopted, and the applied corpus is conceptual and contributes to the control apparatus rather than to the rule [18], [29].

3. Results

3.1 Scope of ASC 470-50 and the same-creditor condition

ASC 470-50 governs the debtor's accounting for a change in debt terms, whether by amendment or by exchange for a new instrument, and its first question is creditor identity. Under ASC 470-50-40-2 an exchange with substantially different terms, or a substantial modification, is an extinguishment; under 40-6 the cash flow test applies only where the two instruments are with the same creditor, so a refinancing with a new lender is always an extinguishment however similar the terms: repaying an old facility with the proceeds of a new facility from a different lender is, under 470-50-40-6 to 40-10, the extinguishment of the old debt and the initial recognition of the new, never a modification, and the cash flow test of 40-10 is reached only where the lender is the same. A syndicated facility is tested lender by lender, and funds that pass through a new facility do not by themselves establish an exchange between the borrower and the original creditor. The condition matters here because a warehouse facility held by a bank group is taken out by securitization notes sold to capital markets investors, so the take-out is an extinguishment even where the economics are close [7]; lender identity is informative in its own right, since renegotiation outcomes change when lenders merge [33] and the tightest covenant is designed around the lead lender's control rights [50]. Seed work describes the lender side of the same-creditor question [61], [62] and how sponsors manage multiple creditor relationships [10], [11].

3.2 The ten percent cash flow test

Where the creditor is the same, ASC 470-50-40-10 treats the change as substantial if the present value of the new cash flows, including fees paid to or received from the creditor, differs by at least ten percent from the present value of the remaining original cash flows, both discounted at the original effective interest rate. Because the test compares present values, a maturity extension with no coupon change can pass or fail depending on the original rate and the length of the extension; where the instrument is prepayable, ASC 470-50-40-12 requires the test to be run with and without exercise, and the smaller change governs; where the instrument has been changed before, ASC 470-50-40-12(f) provides that if within a year of the current transaction the debt has been exchanged or modified without being deemed substantially different, the debt terms that existed a year ago are used to determine whether the current exchange or modification is substantially different, so a large change cannot be split into small ones twelve months apart or closer. Section 3.8 gives a numerical illustration: a coupon increase from 8.0 to 9.5 percent in month three moves the present value by 7.8 percent and is a modification, and a second increase to 11.0 percent in month nine moves it by 7.5 percent against the month-three terms but by 15.7 percent against the terms that existed a year earlier, so the second amendment is an extinguishment. The cumulation rule bears directly on warehouse facilities that are amended and restated repeatedly: Sunnova's filing lists a Second Amended and Restated Credit Agreement of August 22, 2024 and a Third Amended and Restated Credit Agreement of March 20, 2025, and any facility amended twice within twelve months must be tested cumulatively. Amendments cluster: Dou [26] finds that financial covenants are renegotiated frequently with accounting numbers chosen with renegotiation in mind, Demerjian and Owens [27] measure how close borrowers sit to violation, Denis and Wang [57] show that most renegotiations occur outside any violation and transfer control rights to creditors, and Cheng et al. [63] find that creditor control acquired through a violation changes the borrower's tax behaviour. Seed studies describe the forecasting systems that produce the modified schedules [59], [60], [64] and the dashboards

through which the result reaches decision makers [65], [66].

3.3 Fees and third-party costs

The treatment of fees follows the classification. Under ASC 470-50-40-17, if the change is accounted for as a modification, fees paid to the creditor are associated with the replacement or modified instrument and amortised as an adjustment of interest expense over its remaining term using the interest method, while costs incurred with third parties, such as legal and advisory fees, are expensed as incurred. Under ASC 470-50-40-18, if the change is accounted for as an extinguishment, fees paid to the creditor are included in the gain or loss on extinguishment, while third-party costs are associated with the new instrument and amortised over its term. The two outcomes reverse the treatment of each class of cost, so a company with the advisory bills typical of a distressed exchange faces a different income statement under each. The cost of debt literature gives context: Lin et al. [67] and Gu et al. [68] show that the pricing of new debt reflects ownership and institutional characteristics that also drive the fees negotiated in an amendment, and Butt [69] shows that a covenant violation raises the cost of subsequent borrowing. Seed studies describe the negotiation of the fee terms [70]-[72] and the tracking of the amortisation after closing [73], [74].

3.4 Revolving and line-of-credit arrangements

Revolving facilities cannot be tested on cash flows because the borrower controls the draw. ASC 470-50-40-21, which carries forward the consensus of Emerging Issues Task Force Issue 98-14, instead compares borrowing capacity, defined as the product of the remaining term and the maximum available credit, before and after the change. If the new arrangement's borrowing capacity is greater than or equal to the old, unamortised costs, fees paid to the creditor and third-party costs are all deferred and amortised over the term of the new arrangement. If borrowing capacity is less, the unamortised costs and fees are written off in proportion to the decrease in capacity, and the remainder is deferred. Renewable energy companies hold several such arrangements at once; Sunrun's working capital facility, drawn to $336.5 million at June 30, 2025 against $384.2 million at December 31, 2024, is one whose capacity and term are periodically reset. The literature on lines of credit shows that undrawn capacity is itself an economic asset whose value depends on covenant headroom [27], [75], and the seed literature on working capital optimisation and treasury consolidation describes how that capacity is managed across subsidiaries [10], [59], [76].

3.5 Embedded conversion features after ASU 2020-06

Convertible notes raise a further question. ASC 470-50-40-10(b) provides that a modification or exchange is substantial, even where the cash flow test is not met, if it adds or eliminates a substantive conversion option or changes the fair value of an embedded conversion option by at least ten percent of the carrying amount of the original debt immediately before the change. Before Accounting Standards Update 2020-06 most convertible notes carried a debt component accreting to par and an equity component in additional paid-in capital, and an exchange required the consideration to be allocated between them; ASU 2020-06, issued in August 2020 and effective for public companies for fiscal years beginning after December 15, 2021, removed that model and the beneficial conversion feature model, so a convertible note is now a single liability unless the conversion feature is bifurcated as a derivative. The effect for an exchange is that the cash flow test is run on the whole instrument and the conversion option test is run on the change

in the option's fair value [15], [16], [77]. An exchange of convertible notes with the same holders is therefore tested twice, on cash flows under 40-10(a) and on the conversion option under 40-10(b), and either limb alone makes it an extinguishment. Sunrun's repurchases of its 2026 convertible notes, which reduced the outstanding amount to $5.5 million, are in the authors' analysis extinguishments of the repurchased portion measured against the cash paid; the reviewed Form 10-Q for the quarter ended June 30, 2025 reports repurchases of $2.1 million in the first half of 2025 and $183.8 million in the first half of 2024 in the cash flow statement but no separate gain or loss line. Plug Power's case is different in two respects that the reviewed filings establish: the lender of the new secured debentures and the holder of the retired convertible debenture are the same party, Yorkville, so the same-creditor question of Section 3.1 is answered in the affirmative; and the income statement carries a line for the change in fair value of the convertible debenture, so the retired instrument was measured at fair value rather than at amortised cost, which displaces the present value comparison of Equation (1) for that instrument. The earnings per share effects of convertible design show why the classification matters to equity holders [78], [79], and seed work on cognitive bias warns that the judgement is exposed to the preparer's interest in the outcome [80], [81].

3.6 The framework equations

The framework restates the governing paragraphs as six equations. Let CF_t^o denote the remaining contractual cash flows of the original instrument at time t, CF_t^m the cash flows under the modified terms including fees paid to or received from the creditor, r_0 the effective interest rate of the original instrument, B the carrying amount of the original debt immediately before the change, and T the final maturity of the longer of the two schedules. The ten percent test of ASC 470-50-40-10 is Equation (1):

$$\Delta = \frac{\left|\sum_{t=1}^{T} \frac{CF_t^m}{(1+r_0)^t} - \sum_{t=1}^{T} \frac{CF_t^o}{(1+r_0)^t}\right|}{\sum_{t=1}^{T} \frac{CF_t^o}{(1+r_0)^t}} \qquad (1)$$

where the change is substantial, and the transaction an extinguishment, if $\Delta \geq 0.10$ under the governing prepayment assumption of ASC 470-50-40-12. Where the instrument is convertible, the second limb of ASC 470-50-40-10(b) adds Equation (2), in which V_{after}^c and V_{before}^c are the fair values of the embedded conversion option after and before the change:

$$\frac{\left|V_{after}^c - V_{before}^c\right|}{B} \geq 0.10 \qquad (2)$$

If either Equation (1) or Equation (2) is satisfied the old instrument is derecognised. The gain or loss on extinguishment under ASC 470-50-40-2 and 40-18 is Equation (3), in which FV^n is the fair value of the new instrument, F_c the fees paid to the creditor and U the unamortised discount and issuance costs of the old instrument:

$$G = (B - U) - (FV^n + F_c) \qquad (3)$$

If neither test is met the old instrument is carried forward and the new effective interest rate r_1 under ASC 470-50-40-14 solves Equation (4), in which F_c is deferred against the carrying amount and third-party costs are expensed:

$$B - U - F_c = \sum_{t=1}^{T} \frac{CF_t^m}{(1+r_1)^t} \qquad (4)$$

For a revolving or line-of-credit arrangement, ASC 470-50-40-21 replaces Equation (1) with the borrowing capacity comparison of Equation (5), in which L is the maximum available credit and τ the remaining term, and a ratio below one triggers a proportionate write-off of unamortised costs:

$$\kappa = \frac{L_{after}\,\tau_{after}}{L_{before}\,\tau_{before}} \tag{5}$$

Finally, where the change is a troubled debt restructuring, ASC 470-60-35-5 replaces the discounted comparison with the undiscounted test of Equation (6): if $\sum_t C\,F_t^m \geq B$ no gain is recognised and the new rate solves $B = \sum_t C\,F_t^m (1+r_1)^{-t}$; otherwise the carrying amount is written down to $\sum_t C\,F_t^m$ and the difference is a gain:

$$G^{TDR} = \max\left(0,\; B - \sum_{t=1}^{T} C\,F_t^m\right) \tag{6}$$

The equations make the inputs explicit, and each input has a control and an audit procedure in Table 8. Figure 1 shows the sensitivity of Equation (1) to a change in coupon rate for a seven-year remaining bullet note at four original effective rates, with the two term-note examples of Sections 3.8 and 3.9 marked; a coupon change of about 1.8 to 2.2 percentage points is enough to cross the ten percent threshold on a seven-year term, and the threshold is reached sooner at lower original rates because the discount factor compresses less of the change. Debt service optimisation supplies the cash flow schedules on which the test runs [7], and seed studies describe the forecasting systems that produce them [31], [32], [59], [82].

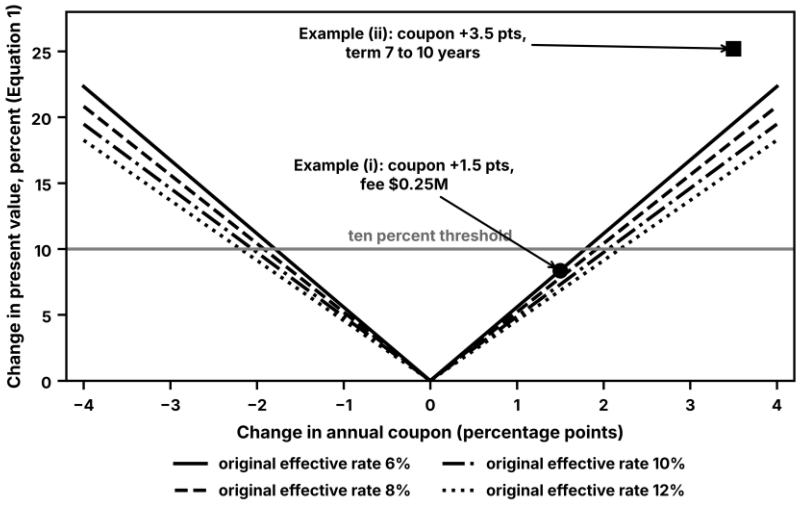

Figure 1. Change in the present value of remaining cash flows under Equation (1) as a function of the change in coupon rate, for a seven-year remaining bullet note at original effective interest rates of 6, 8, 10 and 12 percent, with the ten percent threshold and the worked examples of Sections 3.8 and 3.9 marked; the curves are model output computed from the equation, not from any company's instrument.

3.7 The decision tree

Figure 2 orders the tests. The first node asks whether the debtor is in financial difficulty and the creditor has granted a concession; if so the transaction leaves ASC 470-50 for ASC 470-60 and Equation (6). The second node asks whether the creditor is the same; if not, the transaction is an

extinguishment under ASC 470-50-40-6 and Equation (3) applies. The third node runs Equation (1), and for convertible instruments Equation (2), under the prepayment assumptions and the twelve-month cumulation rule. The fourth node, reached only on a modification, computes the new rate under Equation (4). A separate branch handles revolving arrangements through Equation (5). Table 2 sets the tree out with the fee and cost treatment under each outcome, the part of the standard most often applied inconsistently. The literature on renegotiation shows that the path a transaction takes through the tree is itself a negotiated outcome: Moraux and Silaghi [41] model the optimal number of restructuring rounds, Bourgeon and Dionne [83] model strategic debt holders, and Fan [42] shows that the choice between restructuring methods for publicly traded debt affects investment and subsequent contracting. Seed studies describe the drafting through which that path is fixed [71], [72], [84] and the document-review tools that can read an amendment against the tree [85], [86].

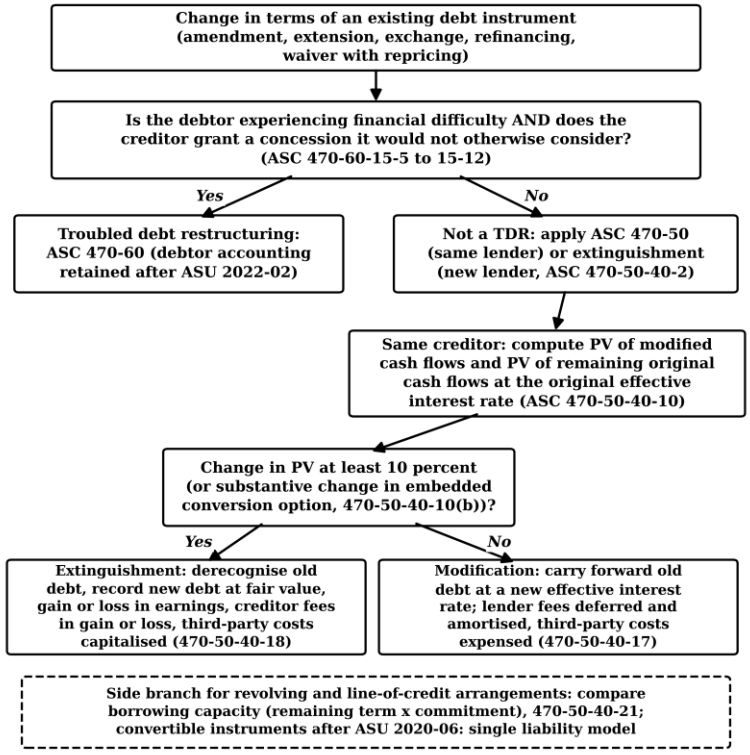

Figure 2. Decision flowchart for classifying a change in the terms of renewable energy debt under ASC 470-60 and ASC 470-50, with the governing paragraph at each node.

Table 2. Decision tree for the classification of a change in debt terms, with the judgement inputs each node requires and the fee and cost treatment under each outcome.

Node	Question and judgement inputs required	If yes	If no	Fee and cost treatment
1	Debtor in financial difficulty and creditor concession (470-60-15-5)? Inputs: the difficulty indicators of 470-60-55-7 to 55-9, the effective borrowing rate before and after (55-10), lender correspondence showing the reason for the concession, and the going concern evaluation	Troubled debt restructuring; apply Equation (6)	Go to node 2	Creditor fees reduce the carrying amount or future payments (470-60-35-10); third-party costs expensed; unamortised costs retained
2	Same creditor (470-50-40-6)? Inputs: holder identity for each tranche from the loan register, agent and trustee confirmations, and the source of any repayment funds	Go to node 3	Extinguishment; apply Equation (3)	Creditor fees and unamortised costs in the gain or loss; third-party costs capitalised against the new debt
3	Revolving or line-of-credit arrangement? Inputs: maximum available credit and remaining term before and after	Apply Equation (5); defer if capacity not reduced, proportionate write-off if reduced	Go to node 4	Creditor fees and third-party costs deferred over the new term; old unamortised costs deferred or written off in proportion
4	Equation (1) at least 10 percent, or Equation (2) at least 10 percent for a convertible? Inputs: original effective rate, modified schedule including creditor fees, prepayment assumptions (40-12), terms in force twelve months earlier (40-12(f)), fair value of the conversion option before and after	Extinguishment; apply Equation (3)	Modification; apply Equation (4)	Extinguishment: creditor fees in gain or loss, third-party costs capitalised; modification: creditor fees deferred, third-party costs expensed, unamortised costs carried forward

3.8 Worked example (i): a term note amendment below the ten percent threshold

The three examples that follow apply the equations to hypothetical instruments whose parameters, all model assumptions, are listed in Table 3; the computations are reproducible by hand from that table and were run by script. The base instrument is a $50.0 million seven-year bullet note with an 8.0 percent annual coupon, a carrying amount of $49.4 million after $0.6 million of unamortised issuance costs, and an original effective interest rate of 8.23 percent, the rate that discounts the remaining contractual cash flows to the carrying amount. In the first example the same lender agrees to raise the coupon to 9.5 percent for the remaining seven years, charges an amendment fee of $0.25 million and the borrower pays $0.15 million to its own counsel. Under Equation (1) the present value of the new cash flows, including the fee paid to the creditor, discounted at 8.23 percent is $53.52 million against $49.40 million for the original schedule, a change of 8.35 percent, below the threshold, so the transaction is a modification. Under ASC 470-50-40-17 and Equation (4) the fee to the creditor is deducted from the carrying amount, which becomes $49.15 million, and the new effective rate that equates that amount to the revised schedule is 9.85 percent; the third-party cost is expensed. Table 4 gives the entries: the only immediate charge to earnings is the $0.15 million of professional fees, and interest expense in the first year rises from $4.07 million under the original rate to $4.84 million, against cash coupons of $4.75 million, the difference being the amortisation of the deferred fee and the original costs. The amendment is the kind that the covenant renegotiation literature describes as routine [26], [57], and the fee negotiation that sets its terms is the subject of seed work on contract negotiation and vendor governance [70].

3.9 Worked example (ii): an exchange above the threshold

In the second example the same note is exchanged with the same holders for a new ten-year note carrying an 11.5 percent coupon; the holders receive a $1.0 million consent fee, the borrower incurs $0.5 million of third-party costs, and the fair value of the new note at issue is $48.0 million, below its $50.0 million face because the market rate for the borrower’s credit exceeds the coupon. Under Equation (1) the present value of the new schedule at the original 8.23 percent, including the consent fee, is $61.85 million, a change of 25.2 percent, so the exchange is an extinguishment under ASC 470-50-40-10. Equation (3) gives the gain: the old carrying amount of $49.4 million is derecognised, the new note is recognised at its $48.0 million fair value, the $1.0 million fee to the creditors is included in the computation, and the result is a gain of $0.4 million. Under 470-50-40-18 the third-party costs are capitalised against the new note, whose carrying amount is therefore $47.5 million and whose effective rate, the rate that discounts the ten-year schedule to that amount, is 12.40 percent; first-year interest expense is $5.89 million against cash coupons of $5.75 million. Table 4 shows the entries. Because the new note is recorded below face, a deterioration in the borrower’s credit that depresses the fair value of what it issues raises the gain on extinguishment and defers the cost into interest expense [52], [87]; the $2.0 million discount accretes through earnings over ten years.

3.10 Worked example (iii): a revolving facility amended with the same lender

In the third example a $100.0 million revolving facility with two years remaining and $0.8 million of unamortised costs is amended with the same lender group, which charges $0.6 million in fees while the borrower incurs $0.2 million of third-party costs. If the commitment is raised to $150.0 million for three years, borrowing capacity under Equation (5) rises from 200 to 450 million dollar-years, a ratio of 2.25, so under ASC 470-50-40-21 the unamortised costs, the fees

and the third-party costs, $1.6 million in total, are all deferred and amortised over the new three-year term at $0.53 million a year, with no charge at the amendment date. If instead the commitment is cut to $60.0 million for three years, capacity falls to 180 million dollar-years, a ratio of 0.90, so ten percent of the old unamortised costs, $0.08 million, is written off at the amendment date and the remaining $0.72 million is deferred with the new fees and costs, $1.52 million in total, at $0.51 million a year. Table 4 gives both sets of entries. The borrowing capacity test never produces a gain and produces a loss only in proportion to lost capacity, which is why warehouse amendments that reset advance rates and pricing without cutting the commitment pass through earnings almost silently [27], [75]; seed work describes the facility summaries from which the capacities are read [59], [76].

Table 3. Parameters (model assumptions) and present value computations for the three worked examples, $ million unless stated.

Item	Example (i): amendment	Example (ii): exchange	Example (iii): revolver
Original instrument	$50.0 seven-year bullet note, 8.0 percent coupon, unamortised costs 0.60, carrying amount 49.40, original effective rate 8.23 percent	Same as example (i)	$100.0 commitment, two years remaining, unamortised costs 0.80
Change in terms	Coupon to 9.5 percent, term unchanged	New ten-year note, 11.5 percent coupon, same holders	Commitment to 150.0 (case A) or 60.0 (case B), three-year term
Fees paid to creditor	0.25	1.00	0.60
Third-party costs	0.15	0.50	0.20
Fair value of new instrument	Not required	48.00	Not required
Present value of original cash flows at 8.23 percent	49.40	49.40	Not applicable
Present value of new cash flows at 8.23 percent, including creditor fees	53.52	61.85	Not applicable
Test result	Equation (1): 8.35 percent, below threshold	Equation (1): 25.2 percent, above threshold	Equation (5): 2.25 (case A); 0.90 (case B)
Classification	Modification (470-50-40-17)	Extinguishment (470-50-40-18)	Deferral (case A); proportionate write-off (case B) (470-50-40-21)
Carrying amount after the change	49.15	47.50 (48.00 fair value less 0.50 capitalised costs)	Deferred costs 1.60 (case A); 1.52 (case B)
New effective interest rate	9.85 percent (Equation 4)	12.40 percent	Not applicable
First-year interest expense against cash coupon	4.84 against 4.75	5.89 against 5.75	Amortisation 0.53 (case A); 0.51 (case B)

Table 4. Journal entries and financial statement effects of the three worked examples, $ million.

Example	Entry at the date of the change	Effect on earnings in the period of the change	Effect in later periods
(i) Modification	Debit deferred amendment fee (contra to notes payable) 0.25, credit cash 0.25; debit professional fees expense 0.15, credit cash 0.15	Expense 0.15	Interest expense at 9.85 percent on 49.15, first year 4.84; deferred fee and original costs amortised to interest over seven years
(ii) Extinguishment	Debit notes payable (old) 50.00; credit unamortised issuance costs 0.60, credit notes payable (new, at fair value) 48.00, credit cash (consent fee) 1.00, credit gain on extinguishment 0.40; debit deferred issuance costs (new note) 0.50, credit cash 0.50	Gain 0.40	Interest expense at 12.40 percent on 47.50, first year 5.89; 2.00 discount and 0.50 costs accrete to interest over ten years
(iii) Revolver, capacity increased (ratio 2.25)	Debit deferred financing costs 0.80 (0.60 fees and 0.20 third-party), credit cash 0.80; old unamortised 0.80 retained	None	Amortisation 0.53 a year over three years
(iii) Revolver, capacity decreased (ratio 0.90)	Debit loss on modification of credit facility 0.08, credit deferred financing costs 0.08; debit deferred financing costs 0.80, credit cash 0.80	Loss 0.08	Amortisation 0.51 a year over three years

3.11 The troubled debt boundary: financial difficulty and creditor concession

A change in terms leaves ASC 470-50 for ASC 470-60 if it is a troubled debt restructuring, which under 470-60-15-5 requires both that the debtor is in financial difficulty and that the creditor, for reasons related to that difficulty, grants a concession it would not otherwise consider. ASC 470-60-55-7 to 55-9 list the difficulty indicators (default or probable default, going concern doubt, delisting, cash flows insufficient to service debt, inability to borrow elsewhere at a non-troubled rate), and 55-10 tests a concession by asking whether the effective borrowing rate after the restructuring is below the rate immediately before it. The screen therefore requires four judgement inputs that no equation supplies: evidence on each difficulty indicator at the amendment date, the effective borrowing rate before and after, the lender’s stated reason for the terms it granted, and the going concern evaluation of the same period, and Table 2 lists them against node 1. A company in Sunnova’s June 2025 position, with default and acceleration under four instruments, meets the difficulty test; whether any pre-petition amendment was a concession depends on the rate comparison, which the reviewed filings do not

report. Troubled debt restructuring is value relevant to investors [2] and its accounting was shaped by political as much as technical forces [1]; Mehmood and De Luca [14] develop a distress screen for restructuring candidates, and Ferry [51] shows that creditor coordination determines whether a concession is reached. Seed studies describe the lender-side screens that correspond to the difficulty indicators [38]-[40] and the borrower-side signals [88], [89].

3.12 Accounting Standards Update 2022-02 and what remains

Accounting Standards Update 2022-02, issued in March 2022, eliminated creditor-side troubled debt restructuring guidance in ASC 310-40, on the ground that the current expected credit loss model already captures a concession, and replaced it with enhanced disclosure of modifications to borrowers in financial difficulty; ASC 470-60 was unchanged, so the debtor still applies troubled debt restructuring accounting. The lender's statements therefore no longer label the transaction a troubled debt restructuring while the borrower's must. The literature on creditor control rights shows that lenders use covenant violations to influence investment, compensation and disclosure [90]-[92], so that the concession the debtor records may be accompanied by tighter non-price terms that the debtor's accounting does not capture. Seed studies describe the cost of maintaining two readings of the same transaction [93], [94] and why the creditor side was simplified [12], [95].

3.13 Debtor measurement under ASC 470-60

Where a troubled restructuring involves only a modification of terms, ASC 470-60-35-5 to 35-9 compare the total undiscounted future payments under the new terms, including contingent payments, with the carrying amount. If the payments equal or exceed the carrying amount, no gain is recognised and a new effective rate equates the carrying amount to the payments, so interest expense falls but no gain appears; if they are less, the carrying amount is written down to the payments, the difference is a gain, and subsequent payments reduce the carrying amount with no interest expense. Assets or equity transferred in settlement are measured at fair value and the difference from the debt settled is a gain. The undiscounted test is more favourable where an extension merely defers payments and less favourable where the new effective rate is very low. Equity-for-debt swaps [96] and earnings management around restructuring [97] document the incentives around this measurement, and seed work describes the anomaly and fraud analytics auditors can apply to it [98]-[100].

3.14 Construction loans that convert to term loans

Table 5, at the end of this group of subsections, summarises the classification of each instrument. Most utility-scale and community solar debt begins as a construction loan that converts on completion into a term loan; a conversion pre-agreed in the original agreement is a contractual milestone and not a 470-50 event, while a conversion accompanied by a repricing, a resizing to a revised coverage ratio, an extended availability period or an overrun tranche must be tested. Such amendments are common because construction outcomes diverge from the base case: Firouzi and Meshkani [7] optimise the debt service schedule against generation risk, Benavides-Franco et al. [8] identify the determinants of project finance success, and Sens et al. [6] document movements in capital expenditure per megawatt. Seed studies describe the delay and overrun mechanisms behind the amendments [47], [101]-[103] and their sources in project management and EPC supply chains [104]-[106]. A loan amended at each tranche funding may fall within the twelve-month rule of ASC 470-50-40-12(f), so the comparison runs from the terms that existed a

year earlier.

3.15 Warehouse facilities and securitization take-outs

A solar warehouse facility is a revolving, borrowing-base facility from a bank group that funds customer contracts until a pool is sold into a securitization, and two 470-50 events recur: the periodic amendment and restatement that resets advance rate, eligibility, maturity and pricing, tested on borrowing capacity under ASC 470-50-40-21, and the securitization take-out, an extinguishment because the securitization investors are new creditors, with warehouse fees and unamortised costs released through earnings and securitization costs capitalised against the new notes. Sunrun issued about $1.4 billion of securitizations in 2025 through July, including a $431 million July transaction at a 6.37 percent yield; Sunnova's filing lists its EZ-Own and TEP Holdings warehouse facilities among the instruments accelerated by its petition. The literature on loan sales and lending relationships explains why the originating banks accept the take-out [107], and the literature on syndicate structure explains the information role of the warehouse lenders [108], [109]. Seed studies describe the origination systems that feed the warehouse [110]-[112] and the controls over the pool data on which the securitization depends [20], [113], [114].

3.16 Tax equity, tax credit transfers and convertible equity portfolio financings

Tax equity partnerships and convertible equity portfolio financings are not debt in form and fall under ASC 810 and the hypothetical liquidation at book value method, but they matter here for two reasons. First, the sponsor's buyout obligation is a scheduled cash obligation: XPLR Infrastructure's January 2025 plan to buy out three of five such financings by the end of 2027, to spread a roughly $1 billion 2030 payment through 2034 and to refinance about $2.8 billion of maturities and buyouts in 2025 and 2026 puts these schedules in the same liquidity plan as debt refinancing; a buyout funded by new debt creates a new instrument, while an upsized or extended holdco facility is tested. Second, tax credit transfers under section 6418 have replaced part of the tax equity layer with cash, $236.1 million for Sunrun in the second quarter of 2025 and $860.9 million in the first half, which raises the share of conventional debt exposed to 470-50 events. The energy policy literature documents how credit design shapes the capital stack [5], [35], and seed studies of ESG integration and climate risk disclosure, and of sustainable financing models describe how investors evaluate those structures [115], [116]. Seed work on regulatory rate of return and capital structure in utility financing, and on capital allocation decision models, describes the sponsor's optimisation [9], [117], [118].

3.17 Convertible notes, exchange offers and repurchases

Convertible notes issued by solar companies between 2019 and 2021 carried coupons near zero and conversion prices far above 2024 to 2025 share prices, so each approached maturity as a cash obligation, and three responses appear in the cases. Repurchase for cash below par, as in Sunrun's reduction of its 2026 notes to $5.5 million outstanding, is an extinguishment under ASC 470-50-40-2 with a gain equal to carrying amount less cash paid, adjusted for any value attributed to the conversion feature. Exchange for longer-dated, higher-coupon notes with the same holders is tested under the cash flow and conversion option rules of Section 3.5, and the outcome frequently turns on the fair value of the new option. Refinancing with a new secured facility from the same lender, as in Plug Power's use of proceeds of its Yorkville secured debentures to retire principal of its Yorkville convertible debenture (about $82.5 million in the April 28, 2025 press release; $60.0 million in the Form 10-Q for the quarter ended March 31,

2025), is first tested for creditor identity: with the same counterparty the retirement and new borrowing are analysed together as an exchange, whereas with a different lender the retirement is an extinguishment and the facility a new instrument. In Plug Power's case the reviewed Form 10-Q for the quarter ended June 30, 2025 reports a loss on extinguishment of convertible debt instruments and debt of $5.5 million for the quarter and $9.1 million for the six months, and a change in fair value of the convertible debenture, so the retired instrument was carried at fair value; how much of the loss relates to the retirement is not stated in the portions reviewed. Management prefers the outcome that preserves diluted share count [15], [78], and holders of distressed convertibles extract non-price terms in the exchange [42], [90]. Seed studies warn against outcome-driven classification [80], [81] and describe the governance that should sit above the judgement [11], [119].

3.18 Change of control and acquisition financing

The acquisition of Altus Power by TPG, completed on April 16, 2025 at $5.00 per Class A share and an enterprise value of about $2.2 billion including debt, raises a different question. Debt that survives a change of control is carried over on its terms, with no 470-50 event, or repaid and replaced with acquisition financing, an extinguishment; a consent accompanied by a repricing or fee is tested as a modification, and pushdown accounting under ASC 805-50, where elected, remeasures the acquired debt at fair value and resets the carrying amount against which later changes are tested. The literature on debt and takeovers shows that creditor protection and change of control terms are priced into the original instrument [34], [120], and seed studies describe the diligence through which the acquirer learns the terms it is inheriting [118], [121], [122].

3.19 Bankruptcy and the limit of ASC 470-50

The SunPower and Sunnova petitions mark the point at which ASC 470-50 stops applying. From the petition date a debtor in possession applies ASC 852: liabilities subject to compromise are reported at the expected allowed amount, interest on unsecured prepetition debt stops accruing unless it will be paid, reorganisation items are reported separately, and a plan may bring fresh-start reporting. Pre-petition amendments remain 470-50 or 470-60 events in the last pre-petition statements, and the acceleration Sunnova reported under Item 2.04 turns long-term debt into a current obligation. Going concern reporting for bankrupt clients [49], [54], [123] precedes such a filing, and seed studies describe the continuity and resilience governance tested in the months before it [37], [44], [124].

Table 5. Classification of renewable energy debt events under ASC 470-50 and ASC 470-60, with the governing paragraph and the verified example.

Event	Governing paragraph	Usual outcome	Verified example	Key input
Construction loan converts to term loan on pre-agreed terms	None (contractual milestone)	No accounting event	Pre-agreed conversion	Original terms
Construction loan repriced, resized or extended at conversion	470-50-40-10; 40-12 (cumulation)	Modification unless PV change of 10 percent or more	Tranche-by-tranche amendments	Original effective rate; cumulation
Warehouse facility amended and restated	470-50-40-21	Deferral, or proportionate write-off if capacity falls	Sunnova credit agreements restated August 22, 2024 and March 20, 2025	Term times commitment before and after
Securitization take-out of warehouse	470-50-40-2; 40-6 (new creditor)	Extinguishment	Sunrun 2025 securitizations, about $1.4 billion through July	Creditor identity
Convertible note repurchase for cash	470-50-40-2	Extinguishment; gain or loss	Sunrun 2026 notes reduced to $5.5 million outstanding	Carrying amount; conversion feature value
Convertible note exchanged with same holders	470-50-40-10(a) and (b)	Cash flow and conversion option tests	Residential solar exchange offers, 2024 to 2025	Conversion option fair values
Convertible debenture retired with proceeds of new facility from same lender	470-50-40-6; 40-10	Single exchange tested on cash flows	Plug Power Yorkville facility, April 28, 2025	Creditor identity
Portfolio financing buyout schedule restructured	ASC 810 and partnership accounting; any funding debt under 470-50	Not a 470-50 event	XPLR Infrastructure 2030 buyout restructuring option	Source of funding debt
Change of control with debt carried over or repaid	470-50-40-2; ASC 805-50 pushdown	Extinguishment of repaid debt; pushdown remeasurement	Altus Power acquisition completed April 16, 2025	Change of control terms; consent fees
Amendment to debtor in financial difficulty with concession	470-60-15-5; 35-5 to 35-9	Troubled debt restructuring	Pre-petition amendments before the SunPower and Sunnova petitions	Effective rate before and after
Chapter 11 petition	ASC 852	Liabilities subject to compromise	SunPower, August 5, 2024; Sunnova, June 8, 2025	Petition date

3.20 Verified events of 2024 to 2025

Table 6 lists the events as the cited filings state them, and Figure 3 places them on a timeline against the standard-setting events of 2020 to 2025. Table 7 then separates, for each company, what the reviewed filings state about the accounting treatment from the classification this paper proposes; the second column is the authors' analysis and is labelled as such, because Form 8-K exhibits report transaction terms and only the periodic reports, of which two were reviewed, report the accounting outcome. Read together, the six events trace one mechanism, maturities and buyout obligations concentrated in 2025 and 2026 meeting a market in which the cost of debt for renewable energy firms had converged with that of other borrowers [3], [33], and the governance that separated the orderly refinancings of XPLR Infrastructure and Sunrun from the petitions of SunPower and Sunnova is the subject of the applied resilience literature [36], [37]. The six events run from SunPower's petition of August 5, 2024, through XPLR Infrastructure's January 28, 2025 distribution suspension and refinancing plan, the completion of Altus Power's acquisition on April 16, 2025, Plug Power's secured debenture facility of April 28, 2025 and Sunnova's petition of June 8, 2025, to Sunrun's report of August 6, 2025 that it had repaid $235 million of recourse debt since March 31, 2024 and had no recourse maturities until March 2027; Table 6 gives the terms and sources.

Table 6. Disclosed 2024 to 2025 debt events at United States renewable energy and clean technology companies, with the disclosure source (the ASC 470 question each raises and the proposed classification are in Table 7).

Company	Event and date	Instruments	Disclosure source
SunPower Corporation	Chapter 11 petitions, District of Delaware, August 5, 2024; stalking horse sale of Blue Raven Solar, New Homes and dealer network to Complete Solaria for $45 million; section 363 process for remaining assets	Prepetition secured debt	Form 8-K Exhibit 99.1, August 5, 2024
XPLR Infrastructure, LP (formerly NextEra Energy Partners)	Common distribution suspended indefinitely; three of five convertible equity portfolio financings to be bought out by end of 2027; about $2.8 billion of 2025 and 2026 maturities and buyouts to be refinanced; option to spread a roughly $1 billion 2030 buyout through 2034	Convertible equity portfolio financings; holdco and project debt	Form 8-K Exhibit 99, January 28, 2025
Altus Power, Inc.	Acquisition by TPG Rise Climate Transition Infrastructure completed April 16, 2025 at $5.00 per Class A share, about $2.2 billion including debt; delisted from NYSE	Term loans and project debt assumed	Form 8-K Exhibit 99.1, April 16, 2025
Plug Power Inc.	Yorkville facility for up to $525 million of secured debentures; $210 million initial tranche; about $82.5 million (press release) or $60.0 million (Form 10-Q) applied to retire convertible debenture principal	Convertible debenture retired in part; new secured debentures	Form 8-K Exhibit 99.1, April 28, 2025; Forms 10-Q for the quarters ended March 31 and June 30, 2025
Sunnova Energy International Inc.	Chapter 11 petitions, Southern District of Texas, June 8, 2025, by three debtors; automatic acceleration of indentures dated August 17, 2021 and September 26, 2023 and of credit agreements restated August 22, 2024 and March 20, 2025	Senior notes; warehouse facilities	Form 8-K, June 9, 2025, Items 1.03 and 2.04
Sunrun Inc.	$235 million of recourse debt repaid since March 31, 2024 through 2026 note repurchases and working capital facility reductions; $5.5 million of 2026 notes outstanding; no recourse maturities until March 2027; about $1.4 billion of securitizations in 2025 through July, the $431 million July deal at a 6.37 percent yield	Convertible senior notes $472.7 million; working capital facility $336.5 million; non-current non-recourse debt $12.9 billion, all at June 30, 2025	Form 8-K Exhibit 99.1, August 6, 2025; Form 10-Q for the quarter ended June 30, 2025

Table 7. Accounting treatment stated in the reviewed filings and the classification proposed in this paper for the six company events (the proposed classification is the authors' analysis, not a disclosed outcome).

Company	What the reviewed filings state about the accounting treatment	Classification proposed in this paper (authors' analysis)
SunPower Corporation	Form 8-K of August 5, 2024: petitions and section 363 process; accounting treatment not disclosed in the reviewed filing	From the petition date, ASC 852; any pre-petition amendment tested under 470-50 or 470-60 in the last pre-petition statements
XPLR Infrastructure, LP	Form 8-K of January 28, 2025: distribution suspension, buyout and refinancing plans; accounting treatment not disclosed in the reviewed filing	Buyouts of portfolio financings are partnership equity transactions under ASC 810; debt raised to fund them is a new instrument, debt amended to fund them is tested under 470-50
Altus Power, Inc.	Form 8-K of April 16, 2025: completion and delisting; treatment of assumed debt not disclosed in the reviewed filing	Debt repaid at closing is extinguished; debt carried over is remeasured only if pushdown accounting under ASC 805-50 is elected; consents with repricing are tested as modifications
Plug Power Inc.	Form 10-Q for the quarter ended March 31, 2025, Note 1: $200.0 million 6.00 percent convertible debenture issued to Yorkville in November 2024 for $190.0 million; $210.0 million initial secured tranche issued May 5, 2025 for $199.5 million; $60.0 million of proceeds applied to retire convertible debenture principal. Form 10-Q for the quarter ended June 30, 2025: loss on extinguishment of convertible debt instruments and debt of $5.5 million for the quarter and $9.1 million for six months; change in fair value of the convertible debenture	Same creditor, so retirement and new debentures are analysed together as an exchange; the convertible debenture was carried at fair value, so derecognition is measured against that amount rather than through Equation (1); new debentures recognised at proceeds less costs
Sunnova Energy International Inc.	Form 8-K of June 9, 2025: petitions and Item 2.04 accelerations; treatment of the 2024 and 2025 restated credit agreements not disclosed in the reviewed filing	The August 2024 and March 2025 restatements, seven months apart, are serial changes to borrowing-base facilities tested under 40-21 and, for any term debt within them, under 40-12(f); from June 8, 2025, ASC 852
Sunrun Inc.	Form 10-Q for the quarter ended June 30, 2025: convertible senior notes $472.7 million (December 31, 2024: $479.4 million); repurchases of convertible senior notes $2.1 million in the first half of 2025 and $183.8 million in the first half of 2024; no separate gain or loss on extinguishment line in the reviewed portions	Cash repurchases are extinguishments of the repurchased portion measured against cash paid; securitization take-outs are extinguishments under the same-creditor rule; working capital facility resets are tested under 40-21

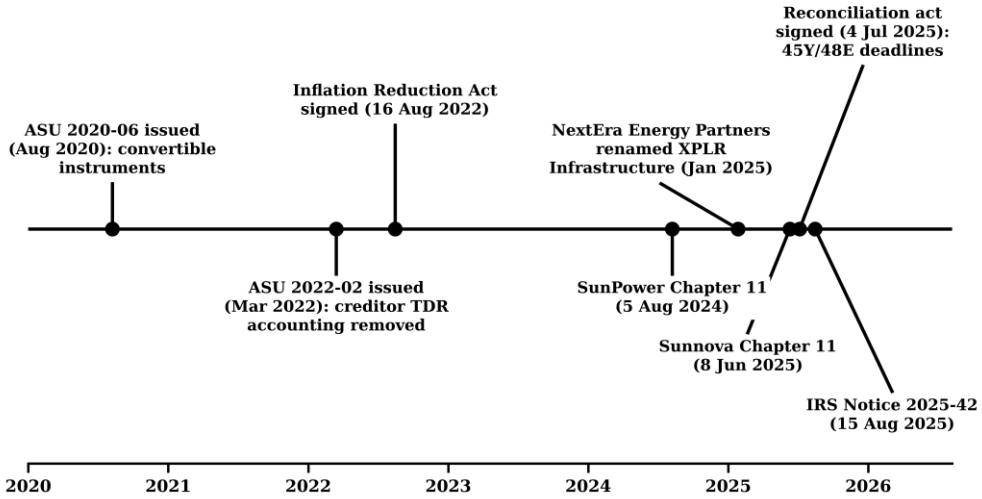

Figure 3. Timeline of the standard-setting and market events from 2020 to 2025 that frame the paper, from Accounting Standards Update 2020-06 to the Sunnova petition and Internal Revenue Service Notice 2025-42.

3.21 Covenant compliance and debt service coverage

The classification feeds back into the covenants that caused the amendment. A modification carries the carrying amount forward at a new rate, so coverage covenants move gradually; an extinguishment records a gain or loss at once, which enters EBITDA-based leverage and net worth covenants unless the definition excludes non-cash extinguishment items. Project-level debt service coverage ratios are indifferent to the classification but sensitive to the new amortisation schedule. Borrowers manage reported numbers around thresholds [25], [97], [125], lenders set covenants with renegotiation in mind [26], [50], renegotiation may be settled partly in equity [126], [127], and the cost of new debt rises after a violation [67], [69]; Levi et al. [75] show that fiduciary duty to creditors reduces covenant avoidance, and Griffin et al. [128], [129] show that violation disclosures move stock and bond prices. Seed studies describe the lender monitoring that follows an amendment [40], [95] and the borrower's compliance forecasting [64], [130], [131].

3.22 Going concern assessment

ASC 205-40 requires management to evaluate at each reporting date whether substantial doubt exists about the entity's ability to continue as a going concern within one year of issuance and whether its plans, including refinancing, alleviate it; a pending amendment is such a plan if it is probable of being implemented and effective. XPLR Infrastructure's plan to refinance about $2.8 billion without equity issuance is the kind of plan management must evaluate; the SunPower and Sunnova petitions are the outcomes going concern reporting is designed to anticipate. The audit literature shows that auditors' going concern decisions are influenced by fee dependence [54], [132], by auditor size [133], by the characteristics of the engagement partner [134] and by local reporting norms [135], and that going concern opinions on bankrupt clients show long-lasting conservatism [49], [123]. Masli et al. [136] find that the determinants differ by industry. Seed studies describe the resilience planning evidence a going concern evaluation draws on [36], [37], [137] and the same evaluation in capital-constrained sectors [89], [138].

3.23 Audit and internal control implications

The classification is a significant audit judgement for any company that has amended debt in the year, and Table 8 sets out the implications: the ten percent test depends on a cash flow forecast and an original effective rate recomputed from loan records, the conversion option test on a fair value that is often a Level 3 input, the same-creditor test on holder identity, and the troubled debt screen on a difficulty assessment that overlaps with the going concern evaluation, and internal control over financial reporting must cover each input. The literature on internal control weakness and debt contracting shows that lenders price control weaknesses into loan terms [43], [55], [139], that weaknesses cluster in complex, rapidly changing companies [140], [141], and that financial statement comparability and internal governance affect loan contracting [109], [142]. Fair value measurement of liabilities and conversion options carries its own audit literature, which documents the counterintuitive income statement effects of own credit risk and the difficulty investors have in interpreting them [52], [53], [143], [144]. Seed studies describe the audit analytics that can be applied to the test [29], [44], [45], [145] and the control design around it [18]-[20], [146].

Table 8. Audit and internal control implications of the ASC 470-50 and 470-60 judgements for renewable energy companies.

Judgement	Key input	Control over the input	Audit evidence	Literature
Same creditor or new creditor	Holder identity for each tranche	Loan register reconciled to lender notices	Agent confirmation; syndicate schedules	Ball et al. [108]; Drucker and Puri [107]; [113]
Ten percent cash flow test	Original effective interest rate; modified cash flow schedule; fees	Independent recomputation; forecast model governance	Recalculation against executed documents	Dou [26]; Demerjian and Owens [27]; [31], [64]
Prepayment option assumption	Contractual prepayment terms	Review by counsel and treasury	Inspection; both-assumption recomputation	Wang [50]; [71]
Twelve-month cumulation	Dates and terms of all amendments in the year	Amendment log maintained by treasury	Inspection of log against amendments	Chu [33]; [10]
Fee and cost allocation	Invoice classification	Invoice coding review	Vouching; cut-off testing	Butt [69]; Lin et al. [67]; [73]
Borrowing capacity test	Commitment and term before and after	Facility summary maintained and approved	Recalculation against agreement	Levi et al. [75]; [59]

Judgement	Key input	Control over the input	Audit evidence	Literature
Conversion option fair value	Volatility, share price, credit spread	Valuation governance; specialist review	Independent valuation; sensitivity testing	Marquardt and Wiedman [15]; Belze et al. [147]; [148]
Financial difficulty and concession	Indicators in 470-60-55; effective borrowing rate comparison	Link to going concern evaluation; audit committee approval	Lender correspondence; rate recomputation	Mehmood and De Luca [14]; Ferry [51]; [40]
Gain or loss on extinguishment	Carrying amount; fair value of new instrument	Derecognition checklist; fair value governance	Recalculation; valuation review	Barth et al. [52]; Chung et al. [53]; [29]
Disclosure	Terms, outcome, covenant status	Disclosure checklist; legal review	Reading of notes against standard	Bourveau et al. [91]; Griffin et al. [129]; [28]

3.24 The applied literature mapped to the framework

The seed corpus does not address ASC 470-50 directly; it supplies the control, analytics and governance apparatus within which the framework operates, and its fourteen themes map to the nodes and inputs of the framework as follows. Oversight of the classification judgement and audit committee approval at node 1 draw on risk governance and compliance analytics [30], [93], [94], [100], [149]. Recording and disclosure of the modified or new instrument draw on financial reporting, consolidation and ledger design [28], [76], [148], [150]. Testing of Equations (1) to (6) and control over their inputs draw on audit analytics, continuous control and IT audit [21], [29], [44], [45], [151], [152]. The cash flow schedules of Equations (1), (4) and (6) and the capacities of Equation (5) draw on treasury, cash flow forecasting and working capital studies [10], [59], [60], [65]. The lender assessment at node 1 and the pricing of amendments draw on credit risk, loan default and asset liability management [12], [38]-[40], [62]. The sponsor's decision to amend, refinance or repay draws on capital allocation and financial planning [9], [66], [118], [153], [154]. The operating causes of amendments, delay, overrun and underperformance, draw on project governance, procurement and energy project management [47], [70], [101], [102], [104], [106], and the revenue risk feeding the cash flow schedule on energy transition, renewable forecasting and community trust [48], [155]-[158]. Investor evaluation of restructured renewable debt draws on ESG, carbon accounting and sustainable finance [115], [116], [159], [160]; the policy shocks of Section 1.2 on tax governance and regulatory strategy [22]-[24], [161], [162]; the screens against outcome-driven classification on fraud, forensic and anti-money laundering analytics [98], [99], [163]-[165]; the behavioural safeguards on ethics, behaviour and decision quality [80], [81], [119], [166]; the drafting of amendments, change of control and force majeure on contracts, legal risk and regulatory compliance [71], [72], [84], [121], [167]; and the origination systems feeding warehouse facilities on banking operations and digital lending [61], [110]-[112], [168].

4. Discussion

4.1 Principal findings against the research questions

On RQ1, the instruments that generate ASC 470-50 events are the construction loan amended at conversion, the warehouse facility amended and restated or taken out by securitization, the convertible note repurchased or exchanged, the convertible debenture refinanced with a related lender, debt affected by a change of control, and holdco debt raised or amended to fund a portfolio financing buyout (Sections 3.14 to 3.19, Table 5). The securitization take-out, the cash repurchase and the new-lender refinancing resolve at the same-creditor node of 40-6, the amended warehouse resolves under the borrowing capacity test of 40-21, and only the amended construction loan and the same-holder convertible exchange reach Equation (1), where the conversion option limb of Equation (2) is frequently decisive [15]. On RQ2, the boundary with ASC 470-60 is crossed only where both financial difficulty and a creditor concession are present, and after Accounting Standards Update 2022-02 the debtor applies that accounting while the creditor does not, so the same amendment can carry two labels [14]; the single-liability model of ASU 2020-06 means the cash flow test runs on the whole convertible instrument and the option test on the change in the option's fair value [16]. On RQ3, the disclosed events (Tables 6 and 7) show that a Chapter 11 petition moves the instrument from ASC 470-50 into ASC 852, that serial warehouse amendments engage the borrowing capacity test and the twelve-month cumulation rule, that concentrated 2025 to 2026 maturities raise the frequency of tests, and that a company which staggers maturities, as Sunrun's disclosure shows, faces fewer and smaller ones [33], [34]; the treatment the companies adopted is documented only in Plug Power's extinguishment loss line, so the other classifications in Table 7 are the authors' analysis of disclosed terms, and the worked examples of Tables 3 and 4 show the earnings effect each outcome would carry. Table 8 names a control and an evidence source for each input [29], [64].

4.2 Interpretation and relation to prior literature

The findings agree with the covenant literature on cause and extend it on consequence. The cases share a cause studied for two decades; concentrated maturities refinanced into a tighter market. Firms choose maturity against rollover risk [169], banks exposed to rollover risk shorten the loans they offer [170], borrowers refinance early to push maturities out [171], delayed refinancing reduces investment through overhang and rollover risk [172], and the market reaction to a refinancing depends on whether senior debt is involved [173]. Ownership and control contestability [174], compensation duration and incentives [175], [176], executive overconfidence [177], pension obligations [178] and social capital [179] all shift maturity; short maturity raises crash risk [180] and interacts with risk disclosure quality [181]; and firm-level climate change risk shortens maturity and raises default risk [182]. The consequence for ASC 470-50 is that the number of classification events per year is a function of maturity structure: Sunrun, with no recourse maturities until March 2027, faces fewer and smaller tests than XPLR Infrastructure, with maturities and buyouts concentrated in 2025 and 2026. Seed studies describe systems that track this exposure continuously [183]-[186] within enterprise analytics platforms [130], [131]. The extinguishment gains of Equation (3) and the conversion option test of Equation (2) both depend on fair value. Barth et al. [52] and Chasteen and Ransom [87] set out the counterintuitive effect by which a deterioration in the debtor's own credit produces a gain; Gaynor et al. [143], Lachmann et al. [144], [187] and Bellandi [188] examine how presentation shapes users' ability to unravel it; Chung et al. [53], Couch and Wu [189] and Wu et al. [190] study fair value option gains and losses on liabilities in the financial crisis; Guthrie et al. [191]

and Jung et al. [192] document the fair value option election; Blankespoor et al. [193] and Fontes et al. [194] show that fair value sharpens the link between leverage and credit risk at banks; Ayres [195] and González-Sánchez [196] examine Level 3 disclosures and credit-adjusted fair value; Belze et al. [147] quantify option valuation model risk; Zhao [197] links securitization gains to loan loss provisioning; and Ai et al. [198] show how ASC 842 changed the value relevance of lease liabilities. For a company whose own credit has deteriorated, the fair value of a new instrument issued in an extinguishment is below face, which raises the gain under Equation (3) and defers the cost into interest expense; preparer, auditor and reader must each recognise the gain as an artefact of the company's own distress. Seed studies describe adaptable valuation governance [199], [200] and the evidence trail fair value inputs require [201], [202].

Both Chapter 11 cases in Table 6 were residential solar financiers, so the third-party ownership model deserves attention. Third-party ownership improves the operational performance of solar systems relative to customer ownership [203] and has been adapted to buildings, rooftop clusters and aggregated battery systems [204]-[206], but a critical review finds that its structure concentrates financing risk in the provider and raises equity questions for customers [46]; adoption studies in Finland and poverty alleviation programmes in China show that the model travels with its financing dependence [207], [208]. The provider's balance sheet is a stack of customer receivables funded by warehouse debt and securitizations, so the warehouse cycle of Section 3.15 is where ASC 470-50 events recur, and third-party credit guarantees lower the cost of that debt where available [209]; the acceleration of Sunnova's two warehouse facilities shows what happens when the cycle breaks. Seed studies describe the investor-side analytics that assess such providers [210]-[213] and the compliance obligations that attach to consumer receivables [214]-[216].

4.3 Implications for practice

For preparers the framework implies three disciplines: an amendment log for the twelve-month test, a forecast model under change control for the schedules of Equations (1), (4) and (6), and a valuation process for conversion options and new instruments independent of the deal team. Accounting conservatism in debt contracts supports efficient liquidation and renegotiation [217], and mandatory accounting changes have in the past triggered covenant violations [218], so the amendment log should also record the covenant definitions that an extinguishment gain would affect. For lenders, contract terms and creditor control are priced [219], [220], corporate social responsibility and credit rating affect private debt contracting [221], and carbon risk management and digital finance lower the cost of debt [222], [223]; a lender that understands the borrower's classification can anticipate the covenant and disclosure consequences of the amendment it is negotiating. For auditors Table 8 implies a quarterly review in which treasury supplies the amendment log and facility summary, the controller recomputes the original effective rate and the present value comparison from executed documents, and the audit committee approves the classification of any facility amended twice within twelve months; seed studies of continuous auditing and of automated close controls describe how that sequence is embedded in the close [20], [44].

4.4 Implications for theory and policy

Equation (1) is only as good as the cash flow schedule, which in renewable energy is exposed to policy. Investment tax credit step-downs and extensions change project economics abruptly [56], [224], renewable energy credit price volatility can strand capital [225], [226], and production tax

credit policy is the product of lobbying [227]. Policy uncertainty delays and sequences renewable investment [228], [229], interacts with credit conditions [230], depresses investment by renewable energy firms [231], [232], responds to policy stringency, cap-and-trade and portfolio standards [233], [234], makes investment lumpy and deferred [235], [236], and has been hedged with green bonds [237]. The termination dates of the July 4, 2025 reconciliation act and Notice 2025-42 are instances, and a lender that re-amortises a loan because credit eligibility has changed creates a 470-50 event whose cash flow inputs must be rebuilt from the revised tax position. Seed studies describe the project-level response to such shocks [238]-[240] and the reporting disciplines that accompany public incentives [241]. For standard setters, the ASU 2022-02 asymmetry and a bright-line ten percent test that can be managed by spacing amendments beyond twelve months are the two features most likely to produce inconsistent outcomes across the sector. Seed studies describe control designs that preparers can adapt [242]-[244], the lender tooling [245], [246] and governance considerations that accompany a restructuring [247], [248]. For theory, the classification outcome appears endogenous to the contracting process: parties that anticipate the accounting consequence can choose an amendment's form, its timing relative to the twelve-month window and the identity of the funding creditor to steer the outcome, a testable proposition that the renegotiation models of Moraux and Silaghi [41] and Fan [42] could accommodate.

4.5 Limitations

The paper is a review and a framework, not an empirical test. Its case set comes mainly from Form 8-K disclosures, which report transaction terms but seldom the accounting outcome; two quarterly reports were reviewed, and only one, Plug Power's, states an extinguishment loss, so Table 7 keeps the disclosed treatment and the authors' proposed classification in separate columns, and the proposed classifications remain to be checked against the companies' annual debt footnotes by a reviewer with access to the full filings and, where judgement is involved, by a United States GAAP specialist. The worked examples are hypothetical and their parameters are assumptions, so they demonstrate the mechanics rather than measure any company's outcome. The equations do not resolve the judgement calls within the codification, such as the fair value of a conversion option or the assessment of financial difficulty, and the seed corpus contributes to the control apparatus rather than to the accounting question. Two further limits are specific to the design. The corpus is weighted toward United States private credit and public bond evidence, so the findings on lender behaviour may not transfer to the bank-syndicated project finance market, where the empirical literature is thinner [7], [8]. And the verified case set is six companies observed over thirteen months; it illustrates the framework but does not measure the frequency of any outcome, and a reader should treat the pattern across the six as suggestive rather than representative [49].

4.6 Future research agenda

Three lines of research follow: a hand-collected sample of modification and extinguishment disclosures by United States renewable energy companies from 2022 to 2025, to show how often the ten percent test is met, how often the conversion option limb decides and how often amendments cluster just outside the twelve-month window; a matched study of debtor and creditor disclosures of the same amendment under ASU 2022-02; and a study of tax credit eligibility and loan re-amortisation as the termination dates approach. Seed studies suggest datasets and methods such studies could draw on [249]-[251] and the integration of accounting,

treasury and operating data they would require [252].

5. Conclusion

This paper asked which debt instruments on United States renewable energy balance sheets generate ASC 470-50 classification events, where the boundary with troubled debt restructuring and convertible accounting lies, and what the disclosed events of 2024 to 2025 show about the consequences of each outcome. The sector's debt is changed often and in forms the standard treats very differently: construction loans convert and are resized, warehouse facilities are amended and taken out by securitizations, convertible notes are repurchased and exchanged, portfolio financings are bought out and refinanced, and in two large cases the whole structure was accelerated by a Chapter 11 petition. The same-creditor condition, the twelve-month cumulation rule, the borrowing capacity test and the conversion option limb of the ten percent test are the points at which these instruments most often turn, and the six equations and four-node decision tree fix the inputs each requires. The answer to the second question is that the troubled debt boundary is crossed only where financial difficulty and a creditor concession coincide, that the debtor and the creditor now account for the same concession under different rules, and that the single-liability model for convertible notes moves the decisive judgement from the allocation of consideration to the fair value of the conversion option. The answer to the third is that the disclosed terms of the SunPower, XPLR Infrastructure, Altus Power, Plug Power, Sunnova and Sunrun events engage every node of the tree, that the treatment adopted is stated in the reviewed filings for only one of them, so the remaining classifications are this paper's analysis of disclosed terms, and that the consequences of each outcome run through covenant definitions, debt service coverage, the going concern evaluation and the audit of the inputs. The worked examples show the size of those consequences: a modification below the threshold changes nothing but the interest rate, an exchange above it moves a gain or loss through earnings at once, and a revolving amendment charges earnings only in proportion to lost capacity.

The framework gives preparers a disciplined route through a standard that is easy to apply inconsistently, lenders a way to anticipate the accounting consequences of the amendments they negotiate, and auditors a map of the inputs that must be controlled. As tax credit termination dates approach and the sector's 2025 to 2027 maturities are refinanced, the volume of classification events will rise, and the cost of getting them wrong, in restated earnings, breached covenants and qualified opinions, will rise with it.

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