



BONDING INTO CLIMATE CHANGE SOLUTIONS

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**Impact Investment: Climate Change, Sustainable
Development and Institutional Investors**

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The Global Imperative

- Commitments under COP 21 to ambitious carbon reduction goal by governments representing both developed and emerging economies around world
- Also buy-in from numerous large corporations around world, from new manufacturing, industrial, finance and energy sectors
- Large financial institutions like Goldman Sachs and Citigroup making major commitments to sustainability
 - Goldman Sachs announced it is tripling goal set in 2012 for clean-energy finance and investment to US \$150 billion by 2025
 - Citigroup published “Energy Darwinism II: Why a Low Carbon Future Doesn’t Have to Cost the Earth” in August 2015, examining costs of action and inaction on limiting global warming to <math><2\text{ C}^\circ</math> compared to pre-industrial levels and concluding that inaction is the more costly option

Political Headwinds

- Brexit (?)
- EU Disunity
- Trump election
- Fall of Renzi Government in Italy
- Post-factual populism
- Fake news and politicization of science
- Climate change a predictive outcome and thus easier to debunk with false science

Capital Requirements

- Estimated that \$22+ Trillion of incremental investment required to meet global carbon reduction goals over next 20 years¹
 - Energy efficiency cost: \$13.5 Trillion
 - Renewable cost: \$8.8 Trillion
- International Energy Agency estimates that to meet 2° C goal, renewable energy capacity must grow from 1.94 terawatts (2015 level) to 3.49 TW in 2025 and 4.53 TW in 2030.²
- Different growth requirements for emerging and developed markets
 - Majority of increased renewable energy investment (over currently projected investment) required in emerging markets
 - In developed markets, majority of increased investment (over currently projected investment) may be in energy efficiency

¹Citigroup, *Energy Darwinism II*, Aug. 2015

²IEA, 2015, “*Medium-term RE Market Report*” (Note: TW = 1 Million megawatts and 1 Billion kilowatts.)

Capacity Not The Issue

- Institutional investors willing to invest in renewable energy and energy efficiency currently have assets under management far in excess of \$22 Trillion³
 - Institutional Investors Group on Climate Change -- \$12 Trillion of AUM
 - Carbon Disclosure Project -- \$95 Trillion of AUM
 - Norwegian Government Pension Fund and other large pension funds, sovereign wealth funds and insurance companies have announced initiatives to make their portfolios environmentally friendly
 - Impact investors/double and triple bottom line investors
 - US \$39 Trillion of investible assets in institutional debt markets in 2014
- Substantial portion of institutional capital is restricted to fixed income (debt) securities that are rated “investment grade” by internationally recognized rating agencies

³Citigroup, *Energy Darwinism II*, Aug. 2015

What Does Investment Grade Mean?

- Any rating from highest (AAA/Aaa) to lowest on scale that receives “investment grade” classification
- Lowest investment grade rating denotes that timely repayment of principal and interest is “likely”
- Below investment grade is “junk bond” or “high-Yield” bond territory
- Comparative lowest Investment Grade Rating Scales:

S&P : BBB-

Moody's: Baa3

Fitch: BBB-

DBRS: BBB

Kroll: BBB

Keys to Attaining Investment Grade Rating for Renewable Energy/Energy Efficiency Bonds

- Corporate debt issued by company which is itself rated investment grade (rare)

OR

- Use of Securitization technology to obtain rating uplift over rating of sponsor
- Irony #1: Same technology whose abuse was a major contributor to Great Recession of 2008 (whose reverberations are still being felt in rise of populism and anti-elitist anger in U.S. and Europe) is the key to the financing of a carbon-free economy
- Irony #2: Same rating agencies who were blamed for yielding to market pressures in creation of housing bubble by assigning irresponsibly high ratings to sub-prime CDOs are now once again the gatekeepers to the institutional capital stash

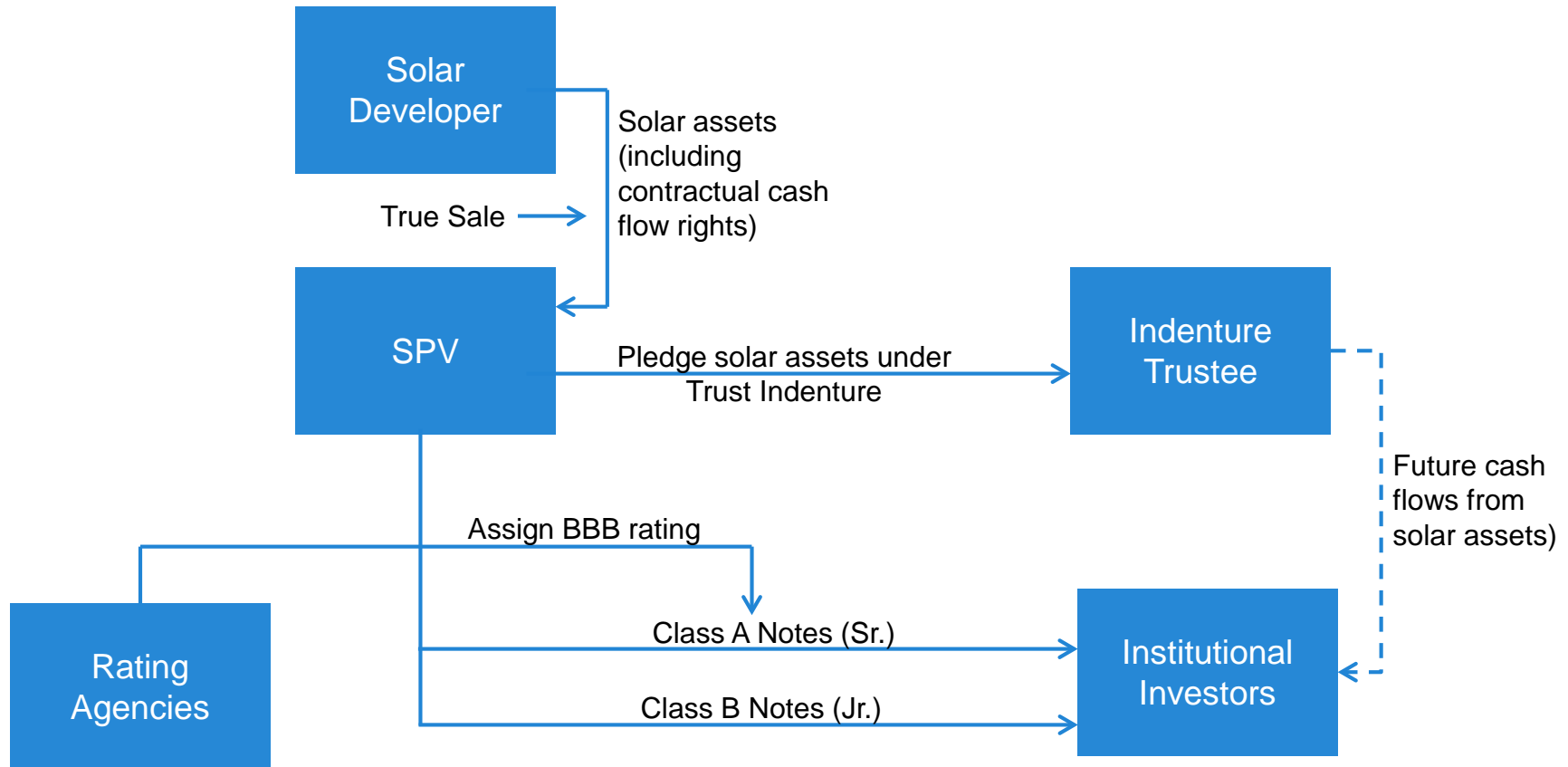
Securitization Market a Deep Cash Pool

- US \$3 Trillion of new ABS/MBS issuance at height of housing bubble in 2007
- US \$1.9 Trillion of new ABS/MBS issuance in 2015
- US \$255.1 Billion of new ABS issuance alone in 2015
- US \$159.4 Billion of new ABS issuance through first 6 months of 2016
- Average daily trading volumes of ABS were US \$196.7 Billion in 2015

Securitization Paradigm for Reaching Investment Grade Ratings

- Ring-fence cash-flow generating assets in bankruptcy-remote special purpose vehicles – e.g., Trusts, Limited Liability Companies
- Reliable and predictable cash flows of sufficient duration to support bond repayment
- Credit support in form of
 - Investment-grade rated obligors on assets being securitized
 - Sufficiently large pool of obligors to support a statistical analysis concluding that repayment of P&I is likely
 - Senior/subordinated structure
 - Third-party (external) credit support
- Stress tests/Monte Carlo simulations run by rating agencies with result that cash flows still sufficient to make timely payment of P&I
- Third-party servicing provided by servicer with strong and durable servicing platform

Securitization Paradigm for Solar Energy Projects



Solar Business Models

- Distributed Solar (Residential)
 - Lease/PPA between Solar Installer and Homeowner
 - Solar panels installed on rooftops of homeowners
 - Solar Installer retains tax benefits and “sells” them to Tax Equity Investors
 - Solar Installer receives future lease/PPA cash flows
 - “Behind-the Meter” power sale to customers
 - Net metering
 - Loan by Solar Installer
 - Homeowner receives tax benefits
 - Solar Installer receives future note payments from homeowners
 - Large portfolios of small unit sizes

Solar Business Models (Cont'd)

- Distributed Solar (Commercial and Industrial)
 - Lease/PPA
 - Solar panels installed on rooftops of commercial properties and lease/PPA entered into with either property owner or third party
 - Solar Installer retains tax benefits and “sells” to Tax Equity Investors
 - Solar Installer receives future cash flows from Lease/PPAs
 - Large portfolio of larger unit sizes
 - Net metering or virtual net metering

- Utility Scale Solar
 - Solar assets installed in array owned by Solar Developer
 - Assets placed under PPA with utility or utilities and power sold at wholesale rates
 - Developer retains tax benefits and “sells” to Tax Equity Investors

Solar Business Models (Cont'd)

- Community Solar (Distribution-Scale Solar)
 - Solar arrays developed to feed electricity directly into local distribution grids
 - Offers communities and utility co-ops benefits of reliable power generation sited near load
 - Offers economies of scale (compared to residential solar)
 - Avoids transmission charges imbedded in utility-scale solar
 - Optimally allows customers that might lack perceived creditworthiness to enter into conventional financing arrangements to participate in solar energy generation
 - Ability to promptly transfer defaulted customer obligation to another customer mitigates (but does not solve) credit risk issue

A Case Study: The U.S. Solar ABS Market

■ The Beginnings

- Solar Access to Public Capital (SAPC) Mock Securitization Project
 - Two-way feedback with Rating Agencies
 - Catalyst for ABS issuance
- First public (144A) solar ABS in U.S.: Solar City I (LMC Series I LLC (Series 2013-1))
 - Deal size: US\$54.4 Million
 - Issuance Date: 11-2013
 - Coupon: 4.8%
 - Collateral: Resi Leases/PPAs (71%) / Non-resi (29%)
 - Overcollateralization: 38%
 - Advance Rate: 62%
 - Class A Notes Rating: BBB+ (S&P)
 - Sub Class – None

A Case Study: The U.S. Solar ABS Market (Cont'd)

■ US Solar ABS Issuance Data (to date)

	SCTY I – SolarCity – LMC Series I LLC (Series 2013-1) November 2013	SCTY II – SolarCity – LMC (Series II) LLC (Series 2014-1) April 2014	SCTY III – SolarCity LMS (Series III) LLC (Series 2014-2) July 2014	Sunrun Callisto – Issuer 2015-1, LLC (Series 2015-1) July 2015	SCTY IV – SolarCity LMC Series IV, LLC (Series 2015-1) August 2015	Aurora Master Funding, LLC Series 2015-1 ⁵	SCTY V- SolarCity FTE Series 1, LLC (Series 2015-A),	SCTY-VI SolarCity LMC Series V, LLC (Series 2016-1)	SCTY-Cash Equity Monetization ⁷	Spruce ABS Trust 2016-E1 June 2016
ABS Coupon/Yield	4.80%	4.59%	4.32% ¹	4.50% ¹	4.41% ¹		5.81% ¹	5.45% ¹	~8-9%	Class A: 4.32% Class B: 6.90%
Bond Size	\$54.4M	\$70.2M	\$201.5M	\$111.0M	\$123.5M	\$100.0M	\$185M	\$57.45M	\$227M	\$83.78M
Collateral	Resi Leases/PPAs (71%)/non-resi (29%)	Resi Leases/PPAs (87%)/non-resi (13%)	Resi Leases/PPAs (86%)/non-resi (14%)	Resi Leases/PPAs	Resi Leases/PPAs	CIMU (70.5%)/ Resi (29.5%)	MyPower Loans	Resi Leases/PPAs	Resi Leases (73%)/ Commercial Leases/PPAs (27%)	Unsecured Energy Efficiency Loans (77.2%)/Solar Loans (22.8%)
Tax Equity	NA	NA	Master Lease	Inverted Lease	Partnership Flip/Back Leverage/Tax Loss Insurance	NA	NA	Master Lease (90.8% of ADSAB)	?	NA
ADSAB ² (PV of cash flows)	\$87.8M	\$106.2M	\$276.0M	\$146.5M	\$182.0M	\$128.0M	\$249.5M	\$76.4M	[201MW]	\$105.374
Overcollateralization ³	38%	34%	27%	24.23%	32.1%	21.88%	25.9%	24.8%	?	Initial 14.5% Target 19.0%
Advance Rate ⁴	62%	66%	73%	75.77%	67.9%	78.12%	74.1%	75.2%	?	79.5%
Senior (Class A) Notes Rating	\$54.4M/ BBB+(sf)	\$70.2M/ BBB+(sf)	\$160M/ BBB+(sf)	\$100M/ A(sf)	\$103.5M/ A(sf)	\$92.5M/ BBB(sf)	\$151.55M/ BBB (sf)	\$52.15M/ BBB(sf) [S]/ BBB+(sf) [K]	NA	\$73.49M/A(sf)
Subordinated (Class B) Notes Rating	NA	NA	\$41.5M/ BB(sf)	\$11M/ BBB(sf)	\$20M/ BBB(sf)	\$7.5M/ B(sf)	\$33.45M/ BB(sf)	\$5.3M/ BB(sf) [S]/ BB+(sf) [K]	NA	\$10.29M/BBB (sf)
Rating Agency Utilized	S&P	S&P	S&P	Kroll	Kroll	Kroll	S&P/Kroll ⁶	S&P/Kroll	NA	Kroll

¹The Yields for these deals are a weighted average based on the size of two tranches offered in each capital structure.

²Aggregate Solar Discount Asset Balance (“ADSAB”) is calculated as the discounted payment streams from leases and PPAs, or notes.

³Calculated as (ADSAB – total Bond Size) ÷ ADSAB.

⁴Ratio of total Bond Size to ADSAB.

⁵Never priced or closed.

⁶S&P rated Senior Notes only.

⁷Based on reported data, actual data not available. Transaction structured as a one-off cash equity monetization with John Hancock Insurance Co. as counterparty, with no rating and with SCTY retaining ~5% of the 20-year cash flows.

A Case Study: The U.S. Solar ABS Market (Cont'd)

- Tailwinds for Solar ABS in U.S.
 - Strong FICO scores (733+)
 - Primarily resi rooftop solar collateral lends itself to RMBS rating methodology (Statistical portfolio methodology (law of big numbers) v. credit-backed contractual cash flow methodology)
 - Bankruptcy-remote special purpose issuers
 - Strong vertically integrated sponsors
 - Cash reserves for P&I, O&M and Inverter Replacement
 - Long-dated (20-year) resi leases/PPAs
 - Tax subsidies for solar and wind extended Dec. 2015
 - 30% ITC for solar extended for another 3 years, then scheduled to ramp down incrementally through 2021 and then remain at 10% beginning in 2022
 - 2.3-cent Production Tax Credit (PTC) for wind extended through 2016, then drops 20% each year through 2020

A Case Study: The U.S. Solar ABS Market (Cont'd)

■ Headwinds

- Friction with tax equity investors
 - Tax Equity constitutes 40%-50% of typical solar asset portfolio capital stack
 - Points of non-alignment between Tax Equity and ABS investors:
 - Pledge of solar collateral can trigger tax recapture
 - Tax Equity requires control over certain key decisions of sponsor
 - Sponsor indemnifies Tax Equity against certain tax risk (including tax basis risk)
- Government Policy risk
 - Net metering rules retroactively changed in Nevada
 - Revised energy rates for utilities

A Case Study: The U.S. Solar ABS Market (Cont'd)

- Headwinds (Cont'd)
 - Government Policy risk (Cont'd)
 - Start-and-stop tax subsidies
 - “Un-smart” grids
 - Production variability, technological performance and obsolescence risk
 - Contract renegotiation risk if grid price reaches parity with solar power cost
 - Commercial and industrial solar – lumpiness and inconsistent credit quality
 - Lack of historical data
 - U.S. solar market fragmented among relatively small developers
 - Large segment of residential users (below 700 FICO scores) not being reached
 - US and EU Risk Retention requirements

Scorecard for U.S. Solar ABS Market

- Only US \$886 Million of total ABS issuance since 1st Solar City transaction in November 2013 (excluding solar component of PACE tax lien securitizations)
- Advance rate between 62% and 79.5% of Aggregate Solar Discounted Asset Balance (ASDAB)
- Overcollateralization requirements between 38% and ~19%
- Ratings ranged between BBB (S&P) and A (Kroll)
- Portfolios securitized either had no tax equity, or had inverted lease structure, or if had partnership flip structure, either covered tax risk with insurance or used back-leverage structure
- All portfolios securitized were predominantly resi leases or PPAs, or resi loans, and one that was majority C&I failed to close
- Coupons ranged from 4.32 to 5.8%, with no downward trend (although macro conditions deteriorated at end of 2015)
- Only solar portfolios with loans, leases or PPAs to users with high FICO scores have been securitized to date

Conclusions: Obstacles and Solutions to Growth of a Global Renewable Energy/Energy Efficiency Portfolio

Obstacles

- Need investment-grade securities to efficiently access institutional capital in quantities necessary to address climate change

- Renewable energy markets fragmented, and need scale to access capital markets

Solutions

- Highly-rated residential or commercial/industrial offtakers (Note: high FICO scores required even for large resi-solar pools, as contrasted with residential mortgage securitization standards)
- Governmental or corporate/insurance company credit support in form of note guarantees or purchase of subordinate bonds

- Cost-effective aggregation facilities
 - Bank-sponsored or government-sponsored warehouse facilities
 - Government guaranteed or subsidized to achieve low-cost financing

Conclusions: Obstacles and Solutions to Growth of a Global Renewable Energy/Energy Efficiency Portfolio (Cont'd)

Obstacles

- Renewable energy markets fragmented but need scale to access capital markets (Cont'd)

Solutions

- Cost-effective aggregation facilities (Cont'd)
 - Collateralized Loan Obligation (CLO) structures
 - Single bank- or government-agency sponsored issue
 - Multiple borrowers with multiple notes and collateral
 - Multi-issuer ABS structures
 - Multiple solar developers pool assets for scaled up ABS
 - Use pass-through trust to ring-fence risk of cross-defaults
 - Apply to renewable energy sector “Megafund” concept developed by Andrew Lo and Roger Stein for early-stage biomedical sector

Conclusions: Obstacles and Solutions to Growth of a Global Renewable Energy/Energy Efficiency Portfolio (Cont'd)

Obstacles

- Commercial and industrial solar/wind hard to securitize because of lumpiness and uneven credit quality

Solutions

- Develop standard corporate off-take agreement
 - Aggregate non-correlated corporate credits into large portfolios and issue multi-tranched securities to offload credit risk to lower-rated (unrated) bond holders
 - Governmental or corporate or insurance company credit support in form of wrap or purchase of first loss position
 - Develop algorithms for predicting probable outcomes of pool of C&I offtakers with heterogeneous credit quality
-

Conclusions: Obstacles and Solutions to Growth of a Global Renewable Energy/Energy Efficiency Portfolio (Cont'd)

Obstacles

- Disconnect between supply of capital and supply of projects
 - Must achieve scale to access capital
- Difficult to penetrate dense urban markets and sparsely populated rural markets (emerging and developed)

Solutions

- Government-sponsored clearing houses
- Social media apps
- Development of robust aggregator business model
- Microgrid finance with roll-ups
 - How to aggregate to sufficient size to access rated ABS market?
 - Need for bridge/warehouse facility
 - Private equity partnerships
- Community (Distributed Scale) Solar
 - Heterogeneous credit quality of customers
 - Interpose distribution utility between solar facility and customers
 - Master lease structure
 - Virtual net metering to supplement cash flows
 - Community Reinvestment Act as incentive for bank participation

Conclusions: Obstacles and Solutions to Growth of a Global Renewable Energy/Energy Efficiency Portfolio (Cont'd)

Obstacles

- Difficult to ring-fence energy efficiency revenues to support financing structures

- Tax and other subsidies often conflict with securitization requirements

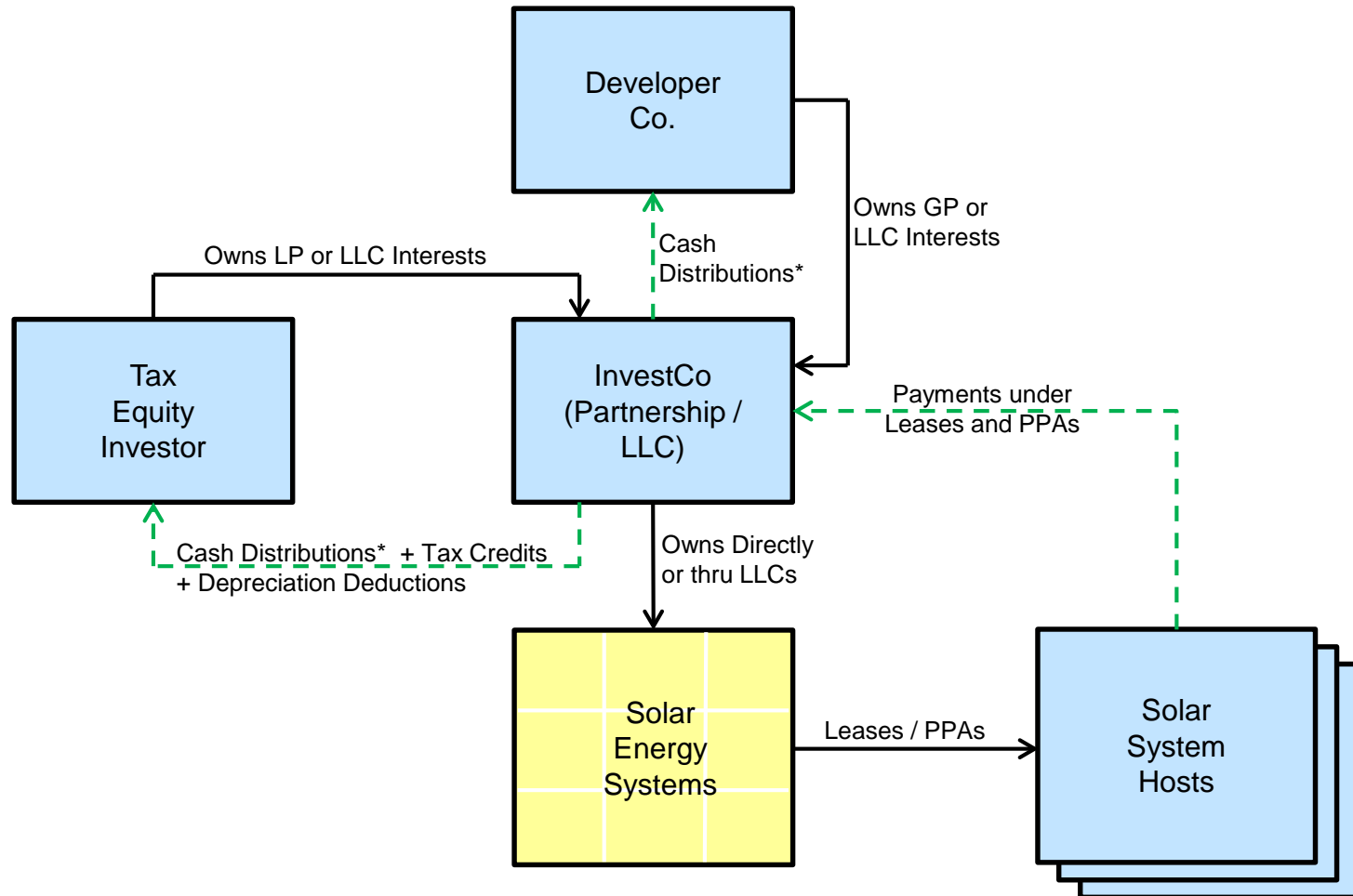
Solutions

- US Property Assessed Clean Energy (PACE) Program – tax liens to support repayment of energy efficiency loans
- Use lockbox mechanism to capture reduction in energy efficiency funder or debt holder

- Design new subsidy programs with securitization requirements in mind
- In case of US tax equity-financed portfolios
 - Use inverted lease rather than partnership flip
 - Use insurance to cover off tax indemnity risk
 - Use back-leverage structure

Appendix I – Typical Solar Partnership Flip Structure and Solar Securitization Structure

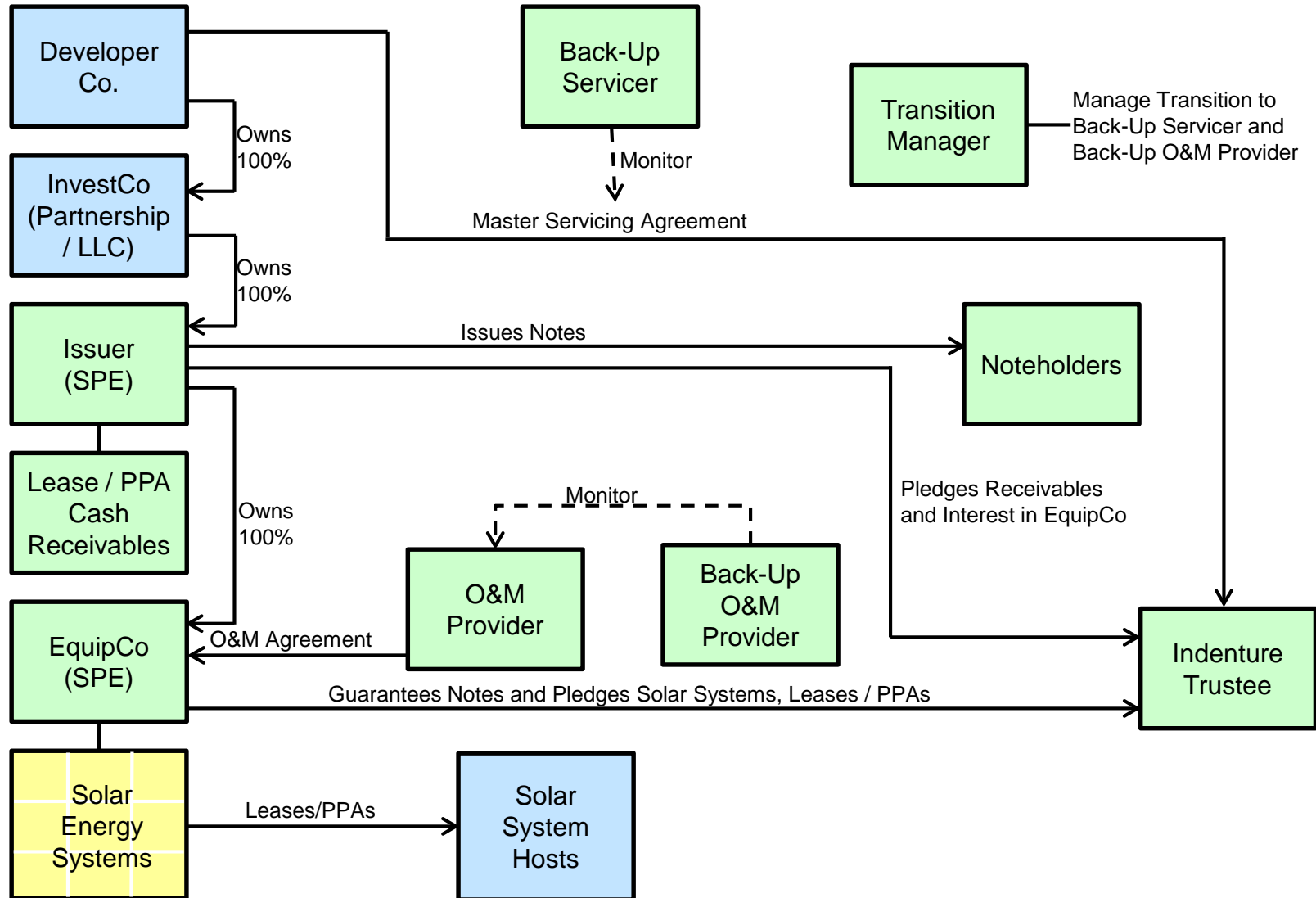
Solar Capital Structure (Pre-Securitization)



*Flips after 5-7 years

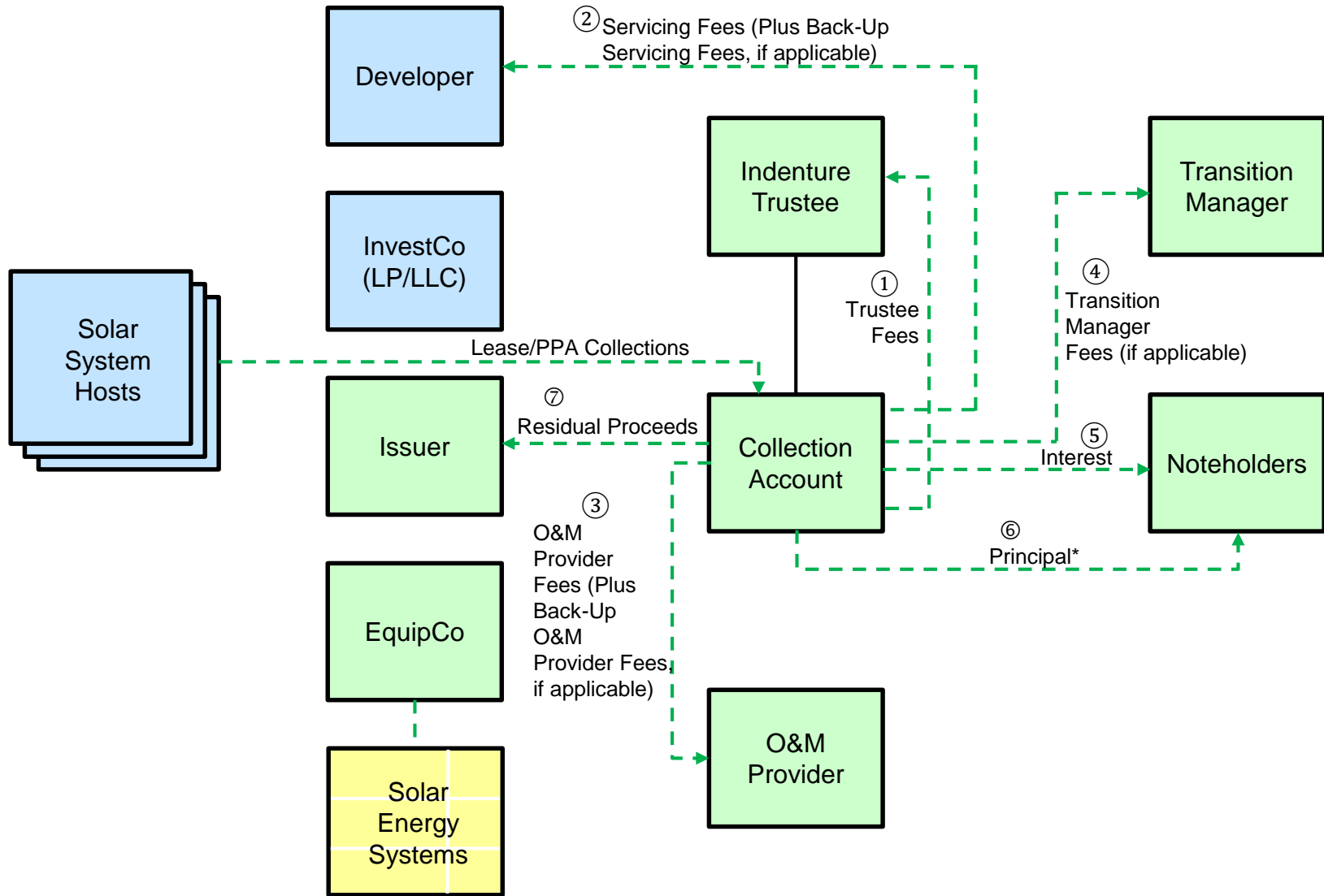
Appendix I – Typical Solar Partnership Flip Structure and Solar Securitization Structure (Cont'd)

Solar Capital Structure (Post-Securitization) (Assumes Tax Equity Paid Off)



Appendix I – Typical Solar Partnership Flip Structure and Solar Securitization Structure (Cont'd)

Post-Securitization Flow of Funds (Assumes Tax Equity Paid Off)

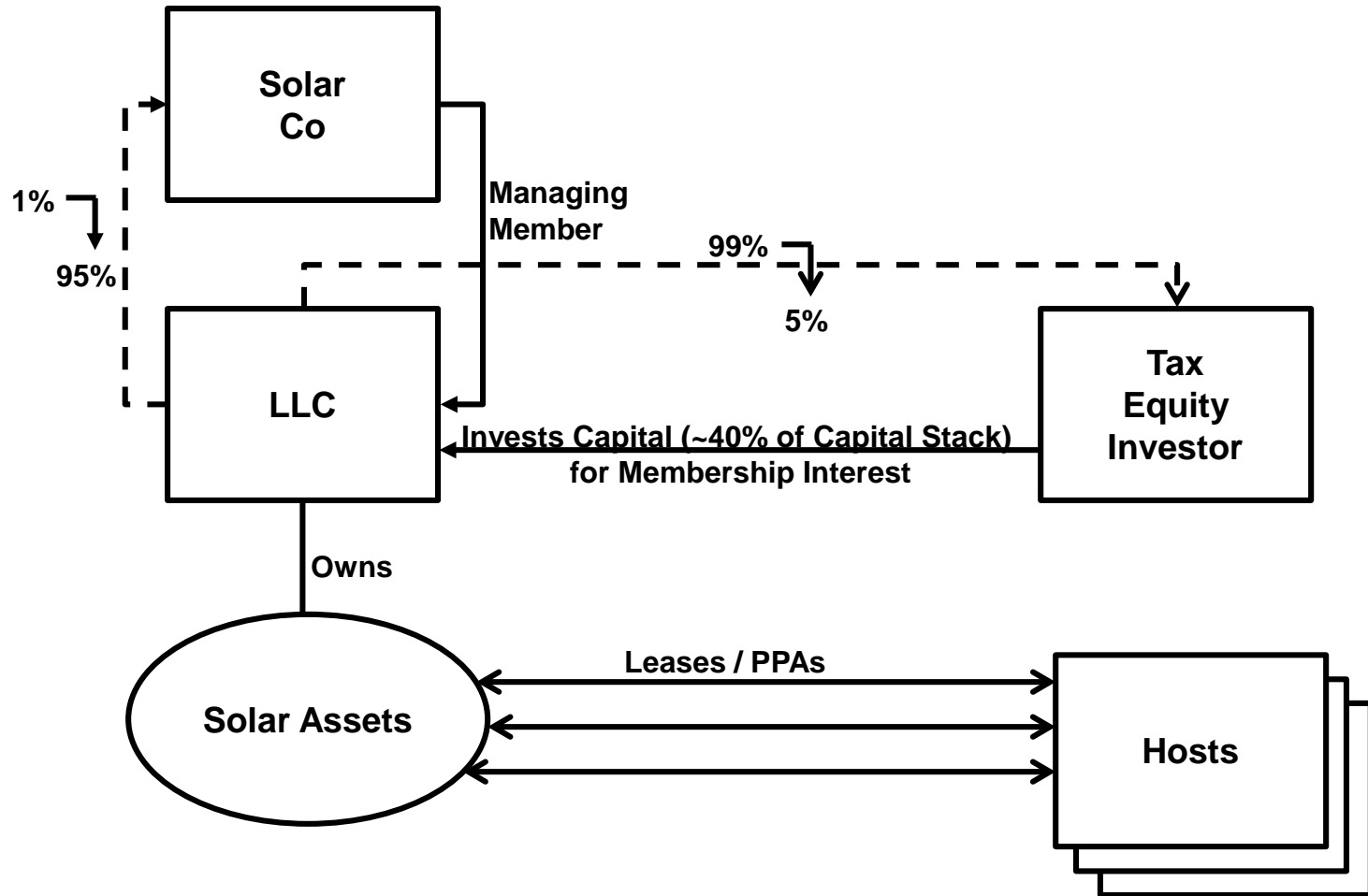


---> = cash flow

*All excess proceeds applied to reduce principal Notes.

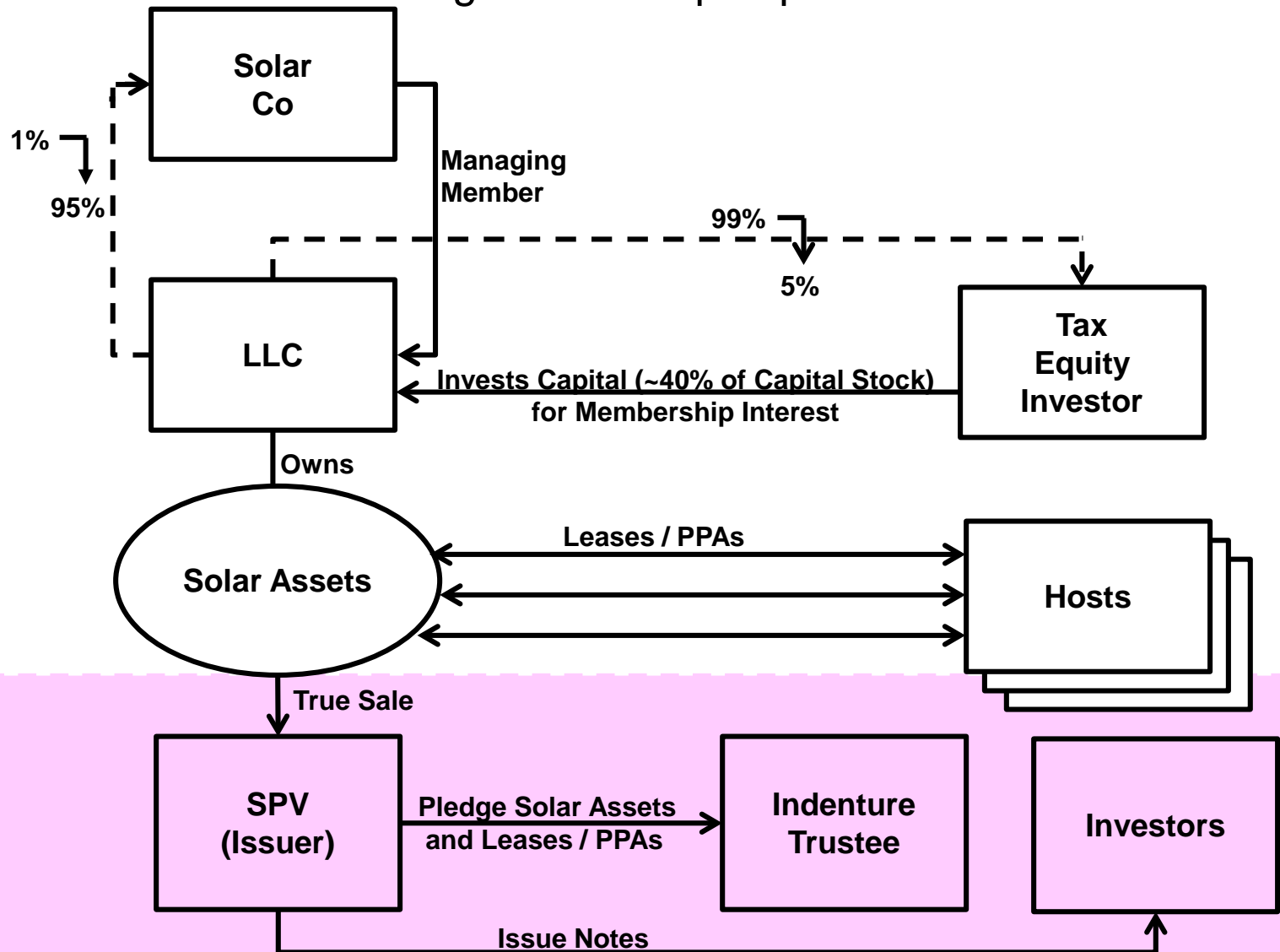
Appendix II – Combining Tax Equity and Securitization Structures

Partnership Flip Structure



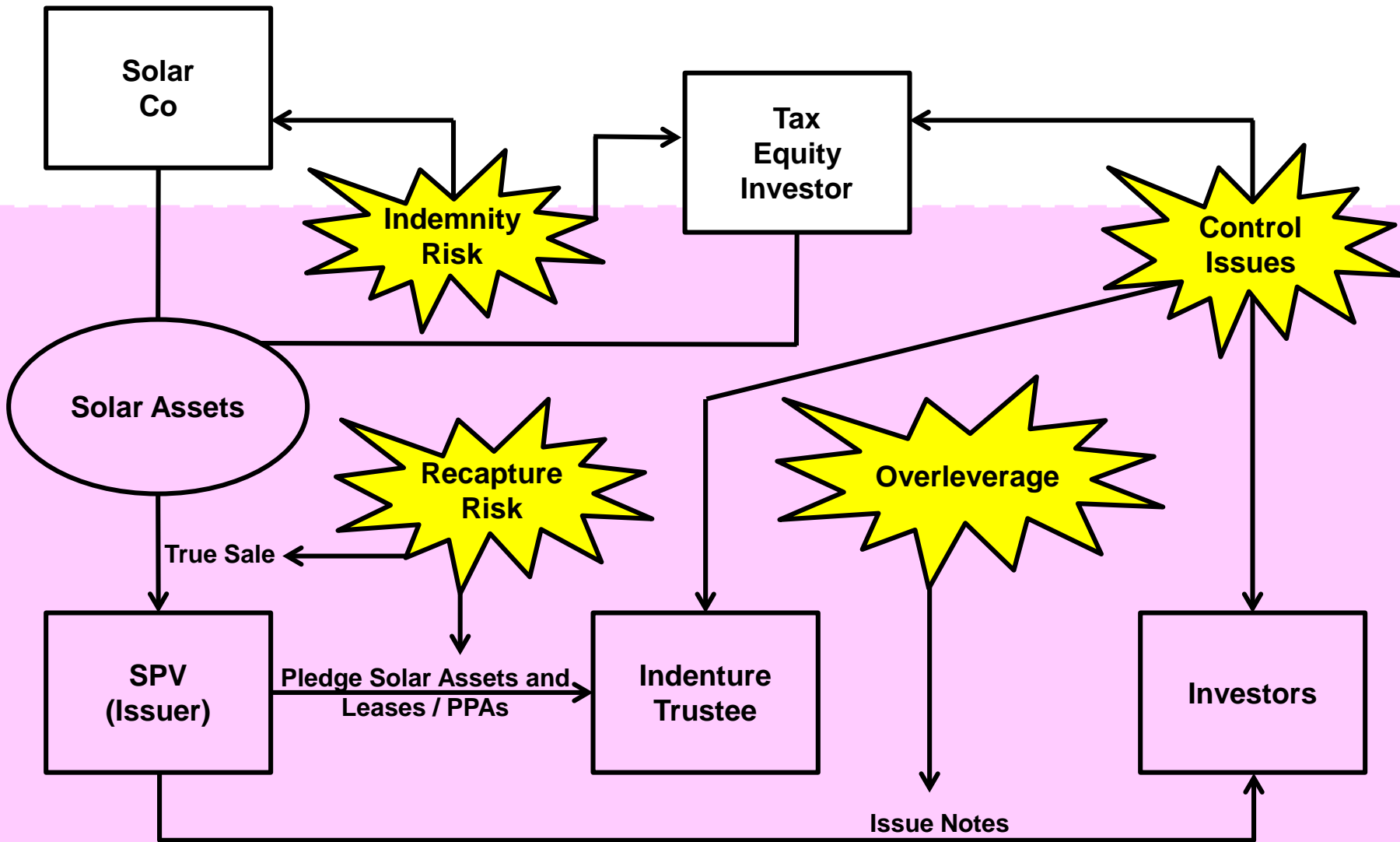
Appendix II – Combining Tax Equity and Securitization Structures (Cont'd)

Securitizing Partnership Flip Structure



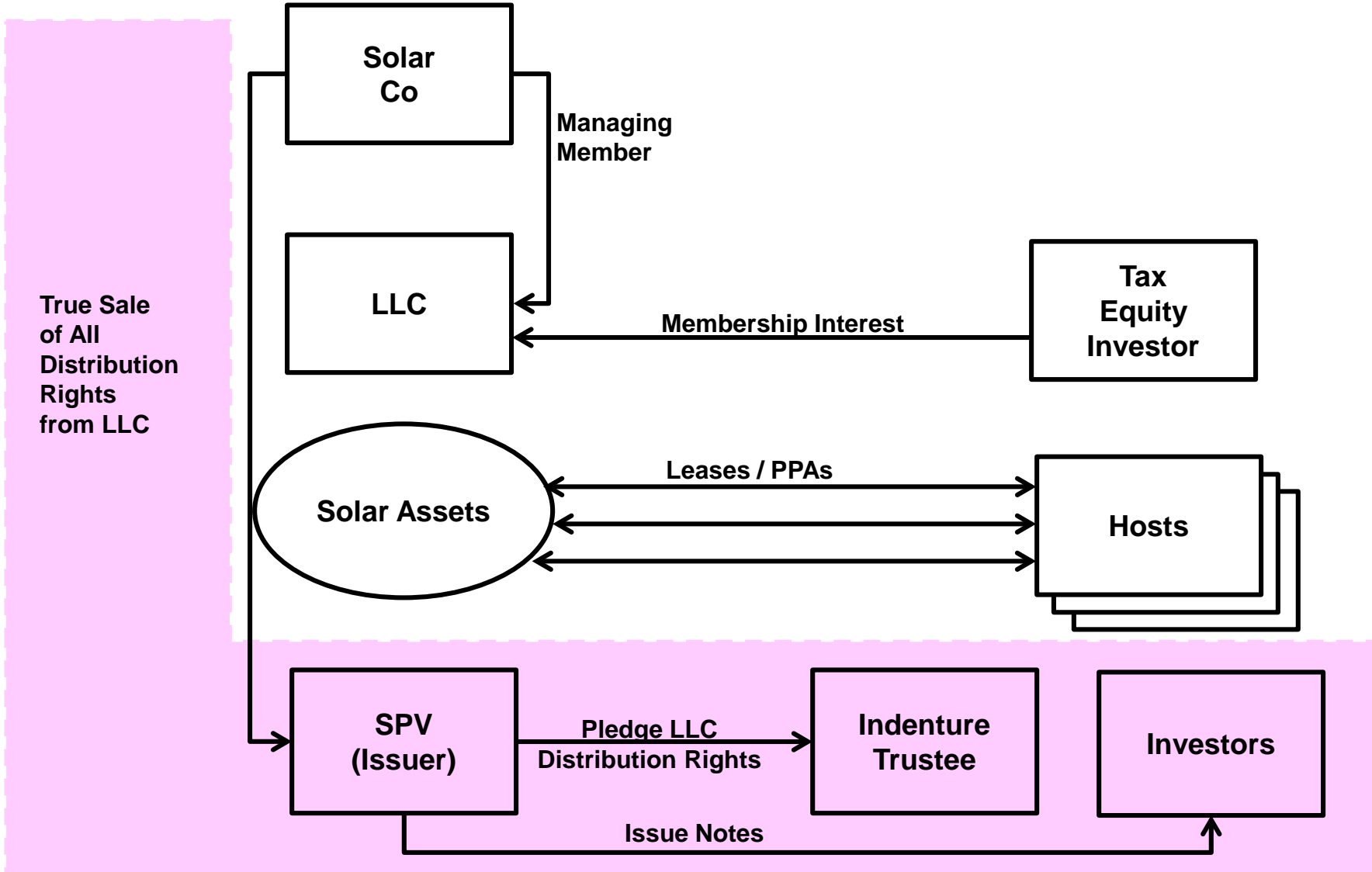
Appendix II – Combining Tax Equity and Securitization Structures (Cont'd)

Friction Points in Securitizing Partnership Flip Structure



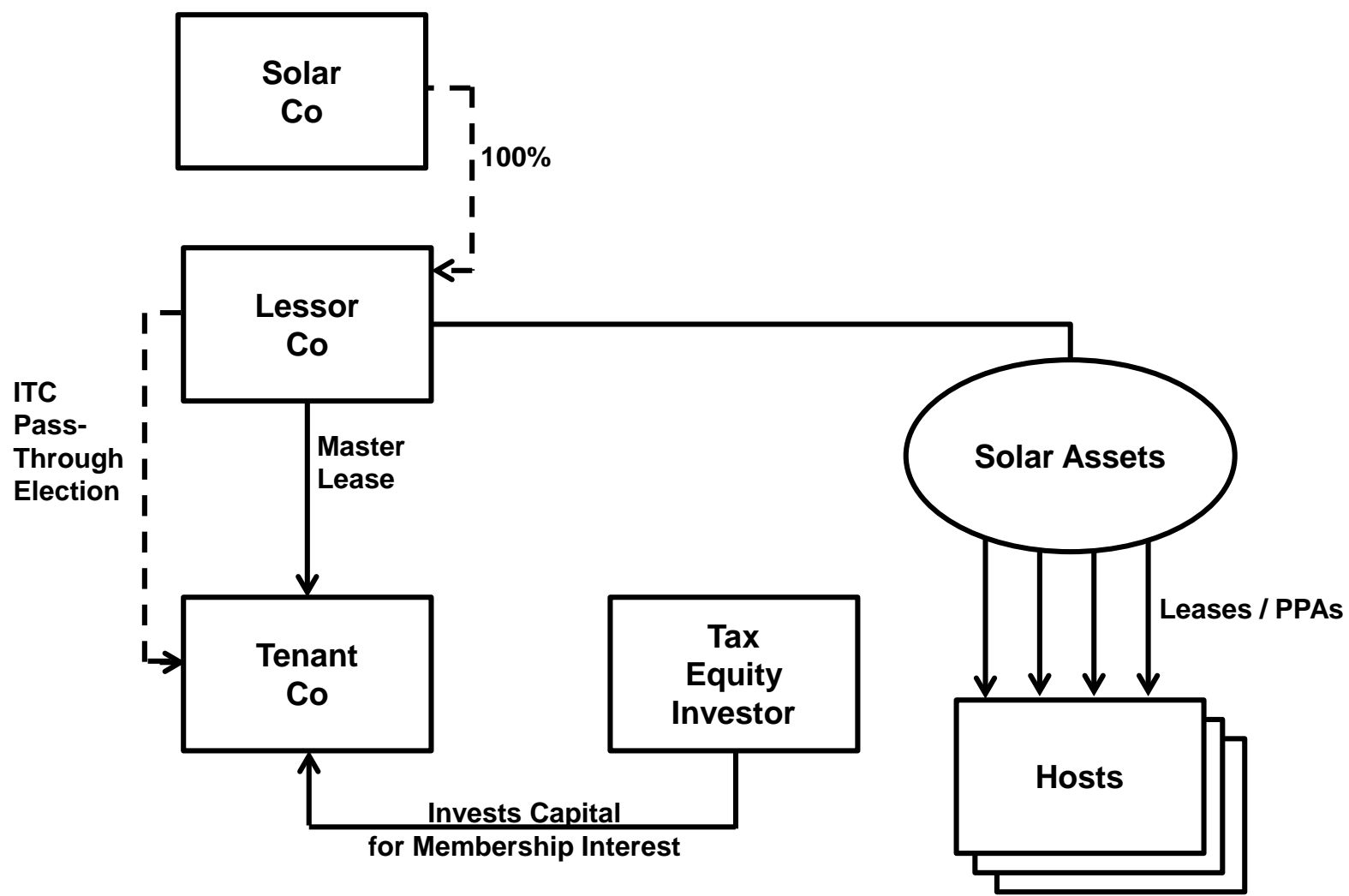
Appendix II – Combining Tax Equity and Securitization Structures (Cont'd)

Workaround for Securitizing Partnership Flip Structure (Backleverage)



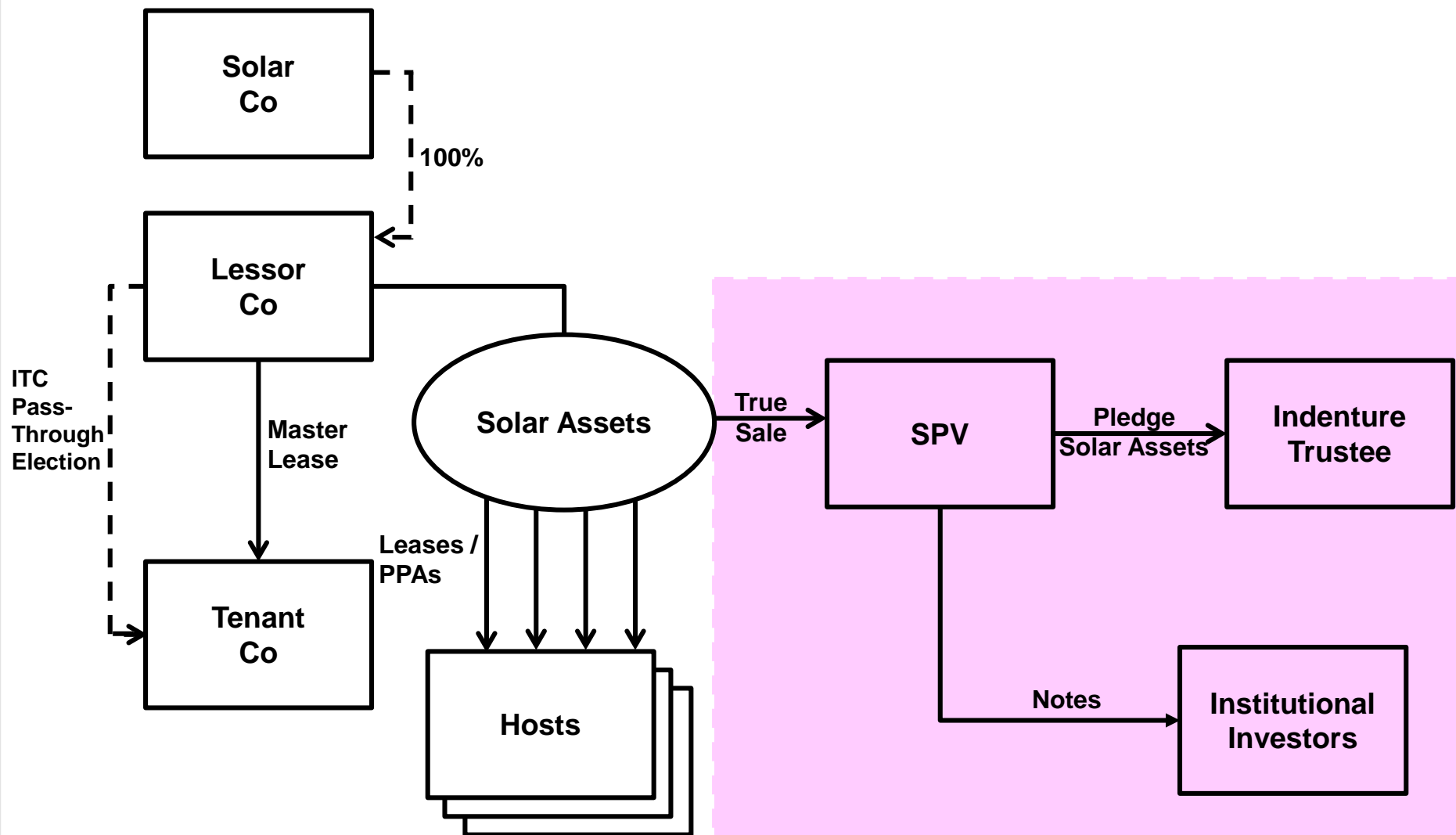
Appendix II – Combining Tax Equity and Securitization Structures (Cont'd)

Inverted Lease Structure



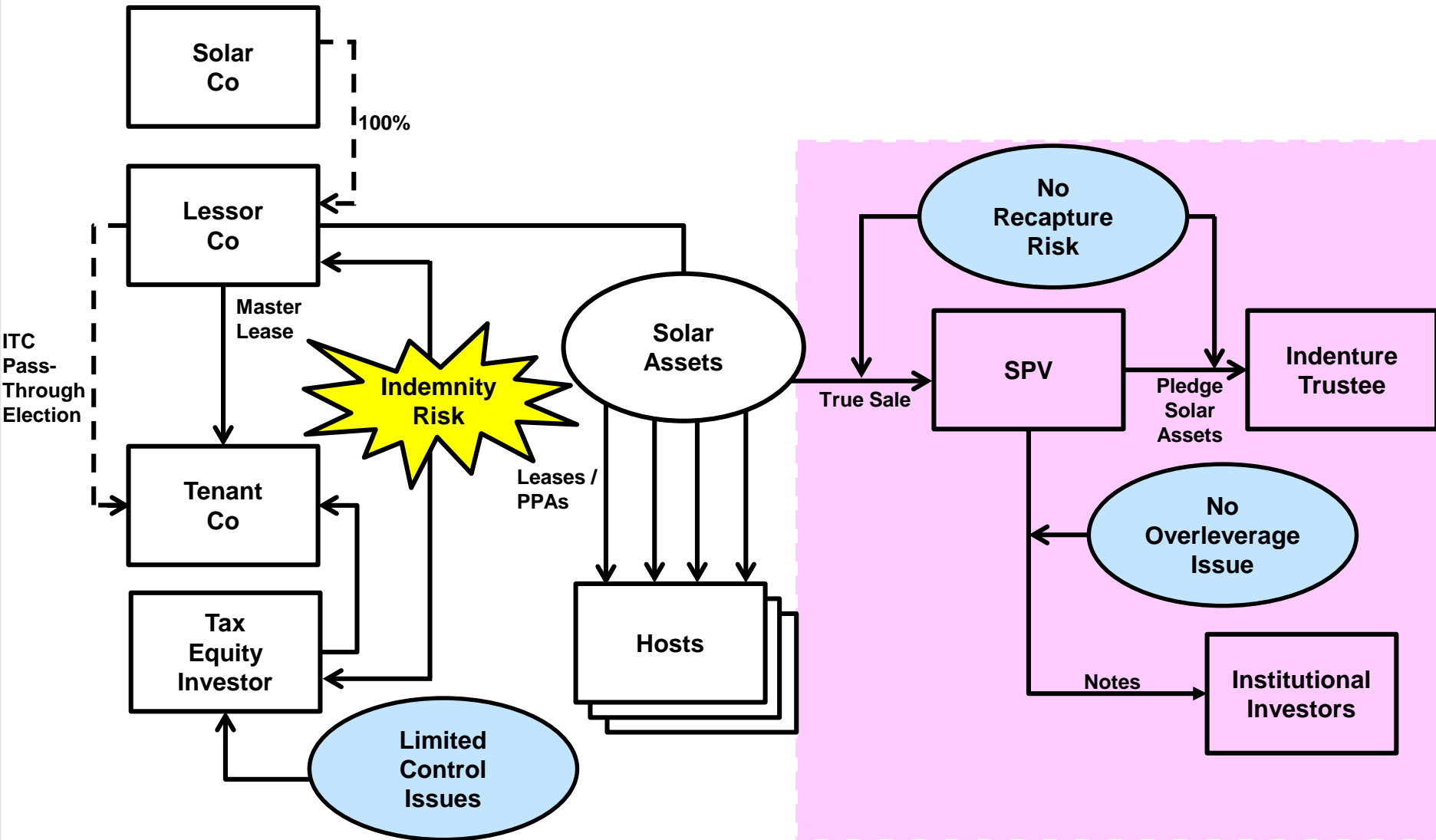
Appendix II – Combining Tax Equity and Securitization Structures (Cont'd)

Securitizing Inverted Lease Structure



Appendix II – Combining Tax Equity and Securitization Structures (Cont'd)

Friction Points in Securitizing Inverted Lease Structure



Appendix III – Comparison Between Resi and C&I Solar Securitization

Commercial Solar PPA Securitization Overview: Middle Market C&I Challenges and Solutions

Resi Solar

- Small Unit Sizes
- No Underlying Credit Support
- Consumer Law Issues
- A Few Large Aggregators
- Developed Rating Methodology
- Three Rated Executions
- Tax Equity Friction
- Lack of Historical Data
- Need for Standardized Documents and Best Practices

vs.

C&I Solar

- Lumpiness → Concentration Risk
- Rated and Unrated Offtakers
- No Consumer Law Issues
- Fragmented Market—Small and Mid-sized Developers
- Rating Methodology a Work in Process
- No Rated Executions
- Tax Equity Friction
- Lack of Historical Data
- Need for Standardized Documents and Best Practices

Appendix III – Comparison Between Resi and C&I Solar Securitization (Cont'd)

Commercial Solar PPA Securitization Overview: Middle Market C&I Challenges and Solutions

C&I Solar:

Problems

- Concentration Risk
- Rated and Unrated Offtakers
- Fragmented Market
- Lack of Standardization
- Lack of Historic Data
- Tax Equity Friction

Responses

- Concentration Limits and Larger Pool Sizes
- Synthetic Ratings for Unrated Offtakers
- Warehouse Facilities to Fund Aggregation
- SAPC-Sponsored Standard Resi and Commercial PPAs and Leases and Installation and O&M Best Practices
- SAPC-Sponsored System and Credit Performance Data Sets
- SAPC-Sponsored Tandem Tax Equity / Securitization Model

Appendix III – Comparison Between Resi and C&I Solar Securitization (Cont'd)

Commercial Solar PPA Securitization Overview: Middle Market C&I Challenges and Solutions

C&I Warehouse Facility Requirements

- Sufficient tenor (5-year) to permit critical mass aggregation
- Support aggregation to sufficient size to facilitate securitization or sale to another aggregator / Yield Co / REIT
- Revolving credit feature to recycle proceeds after securitization or sale exit
- Available to support construction and seasoning of assets
- Public-Private Partnership with Green Banks / DOE to credit enhance at facility or project level
- Compatible with Tax Equity Participation

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