

Project Bonds: New Energies – Solar

Crédit Agricole CIB, a leader in the global Project Bond market, is authoring a series of articles covering key topics for issuers to consider.

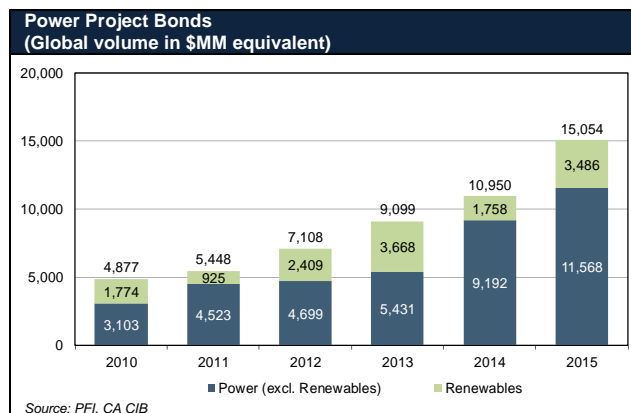
New Energies

The volume of Project Bonds issued for renewable energy projects has steadily increased in recent years.

The Capital Markets opened its doors to renewable energy projects with a wind Project Bond in 2003, followed by solar Project Bonds a few years later in 2010.

These trail-blazing transactions allowed investors to gain familiarity with the technologies, risks, and contractual arrangements related to renewable assets. They also paved the way for future issuances, as rating agencies started publishing specific methodologies dedicated to this newly accessible asset class.

Renewables have grown to represent nearly 25% of power Project Bonds and 10% of total Project Bonds issued in just over a decade. In 2015, renewable energy projects accounted for \$3.5BN of Project Bond issuances globally.

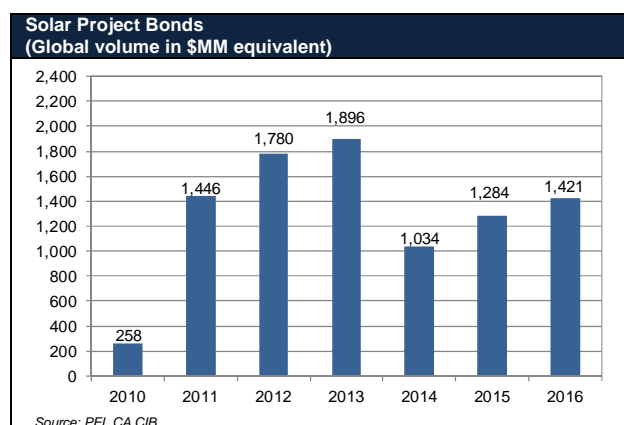


Renewable Project Bonds first gained traction in North America, followed by projects in Europe and Latin America, demonstrating the increasing comfort and global appetite among investors for renewable assets.

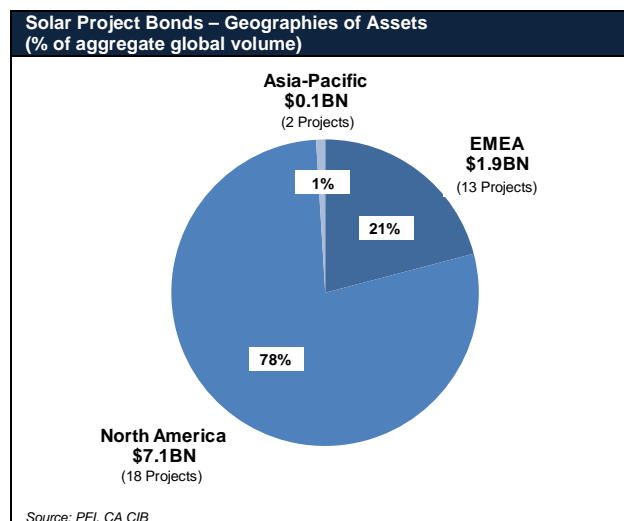
While renewables offerings have gained wider acceptance over time, there are challenges that need to be considered prior to approaching the Capital Markets. Lessons learned from past renewable financings can help ensure future successful executions.

This article provides a review of historical Project Bond issuances for utility-scale solar assets globally.

Solar Project Bonds



Historically, the first solar Project Bond issuance was the €196MM Andromeda Finance offering for a 51MW utility-scale PV Italian solar project in December 2010. In 2011, the \$702MM Project Bond for NextEra Genesis Solar, a single-site Concentrating Solar Power (CSP) project with a capacity of 250MW in California, marked the opening of the US Debt Capital Markets for solar projects. Since then, more than \$9.0BN has been raised globally for 33 utility-scale solar projects with individual issuances ranging from €17MM to \$1,000MM. Solar Project Bonds have successfully been executed in 6 different currencies.



North America remains the most active region with 18 solar projects financed to-date out of 33 globally. Both the US and Canadian Capital Markets have welcomed large

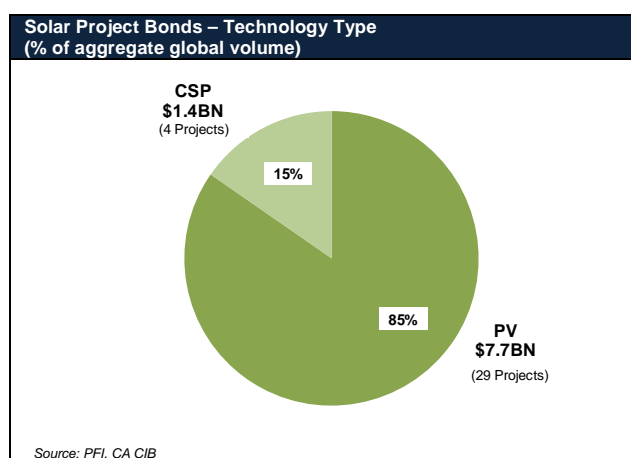
transactions such as the \$1,000MM Solar Star Funding transaction in 2013 and the C\$613MM Grand Renewable Solar in 2013.

With 13 offerings to-date, Europe is the second largest region by volume for solar Project Bonds and regularly sees transactions for projects of various sizes.

Outside North America and Europe, solar Project Bonds are less frequent but these financings are emerging in Asia. In 2015, the ¥3,000MM offering for Aomori-Misawa, a 10MW operating solar farm, was the first Capital Markets transaction for an Asian solar project. It was followed the same year by the ¥6,200MM Canadian Solar Portfolio offering for a 21MW PV solar project.

The majority of proceeds from solar Project Bonds have financed greenfield projects, as both rating agencies and investors are comfortable with the low construction risk involved for solar projects. Also, the construction period is generally short, thus negative carry can be more easily mitigated. Project Bonds issued to refinance operating solar projects have also been successfully placed.

Utility-scale solar assets are mostly contracted through long-term Power Purchase Agreements (“PPAs”) with an offtaker such as a utility or a public entity (State, municipality, etc.). Project Bonds have allowed issuers to fully monetize these contracts with amortizing structures over the full tenor of the underlying PPA, i.e. without any tail. Maturities of 20 years or more are the norm for this type of transaction, with average weighted lives above 10 years.



Solar projects rely on different technologies to convert sunlight into electricity. While Photovoltaic (PV), Concentrating Solar Power (CSP) and Concentrating Photovoltaic (CPV) technologies are the three main technologies used for utility-scale solar plants, projects relying on PV technology account for most of the transactions to-date. Capital Markets participants have also financed parabolic trough systems, the most common form of CSP technology.

Trends and Highlights

A wide variety of utility-scale solar assets has been financed through the Project Bond market. Depending on the characteristics of the project, different structures have been successfully placed. The following section discusses some of these transactions, as well as current trends.

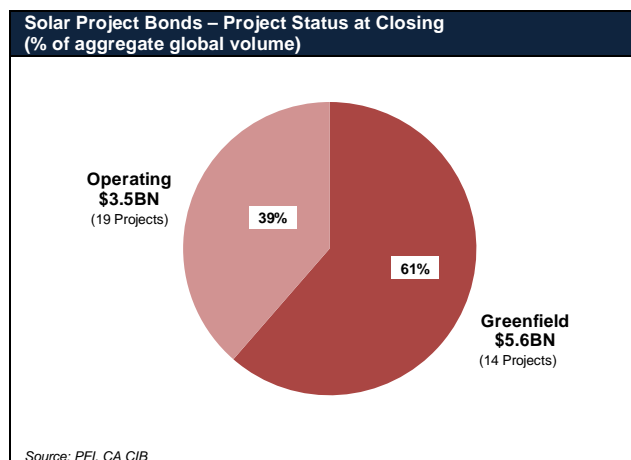
Financing Solar Technologies

The vast majority of utility-scale projects financed in the Capital Markets has used photovoltaic (PV) technology. PV technology directly converts sunlight into electricity through the acceleration of electrons in the PV cells. In this regard, PV plants using crystalline silicon (c-Si) panels, including monocrystalline and polycrystalline, have been used for many years and are the most common technologies financed with Project Bonds.

Concentrating solar power (CSP) technology, while carrying a slightly higher complexity and operating risk, has also been financed through Project Bonds. A CSP project collects and concentrates the heat from the sun with highly reflective mirror panels and focus the heat onto a receiver filled with a highly conductive fluid, such as synthetic oil. This fluid is then used to create steam and power a conventional steam turbine to generate electricity.

Another technology used for utility-scale solar projects is the Concentrating Photovoltaic (CPV) technology. CPV directly converts sunlight into electricity, as PV does, but uses a lens system to concentrate the sunlight similar to CSP. To our knowledge, no projects relying on this technology have yet been financed in the Capital Markets.

Key technology risks include complexity of installation, degradation factor, commercial track record, and applicability of the solar technology to be used in relation



to the geography of the project. The technology and proposed design will need to be reviewed by an independent engineer before launching the offering.

Approaching Technology Risk: Case Study

The first offering for a CSP project was the \$702MM issuance for NextEra Genesis Solar, a 250MW parabolic trough solar project in California. Issued in 2011, this transaction was also the first Capital Markets financing for a utility-scale solar project in the US.

The project consists of two 125MW parabolic trough solar fields and corresponding power blocks. The project is based on a Rankine power cycle with a reheat steam turbine generator designed to use solar radiation from parabolic trough technology. Two independently operated 140MW power blocks are fed thermal energy from solar collection systems. The solar panels capture and concentrate sunlight to heat synthetic oil, which then heats water to create steam. Steam is then pumped to an onsite turbine generator to produce electricity.

While the offering was rated AAA on the back of guarantees provided by the Department of Energy, Fitch considered the parabolic trough technology as proven and one of the oldest operating CSP technologies. Fitch also noted the sponsor's familiarity with this technology as a credit positive.

Construction Financing for Solar Assets

Capital Markets offerings have been successfully placed for greenfield projects. Construction of utility-scale solar project primarily includes permitting, procuring panels, installation and interconnection. The complexity of the overall design of a solar project tends to be relatively low compared to other power projects and the construction period is short, usually less than a year. For these reasons, investors are comfortable with construction risk and an investment-grade rating is achievable for greenfield projects.

Furthermore, sponsors typically secure comprehensive EPC contracts with experienced contractors. Fixed price, date certain contracts with adequate performance and delay liquidated damages (LD) clauses are standard in this industry, and are consistent with investment grade ratings.

Approaching Construction Risk: Case Study

In June 2013, Solar Star Funding issued \$1,000MM in series A senior secured notes to finance the construction of a 579MW PV project in California. Two locations were constructed in parallel over a two-year period. With

\$2,740MM of construction budget, this project remains one of the largest ever financed in the Capital Markets.

The issuance was rated Baa3 / BBB- / BBB- by Moody's, Standard and Poor's and Fitch. The rating agencies noted the date-certain, fixed-price contract executed with SunPower, an experienced party, as a credit positive. The contract included milestone payments and a substantial early completion bonus payment if the project was completed ahead of schedule.

In March 2015, as the project was reaching completion ahead of schedule, Solar Star Funding issued \$325MM in series B senior secured notes (pari passu with the series A) to repay part of the construction costs to the sponsor. Moody's and Fitch reaffirmed their initial ratings while S&P upgraded its rating by one notch to BBB.

Solar Project Bonds in New Geographies

While the vast majority of issuances come from North American and European assets, more recent transactions in Asia have demonstrated the applicability of solar Project Bonds in new geographies.

New geographies: Case Study

Canadian Solar tapped the Japanese Capital Markets in 2016 to finance the 10MW PV Aomori-Misawa project with a ¥3,000MM issuance. The Project Bond had a two-year grace period, a 20-year tenor, and was rated by a local rating agency. Incorporated in Canada, with the bulk of its operations in China, Canadian Solar had limited relationships with local banks and decided to rely on institutional investors instead. This transaction was the first asset-backed security arranged by a foreign sponsor in the Japanese solar market.

In 2016, following its initial successful transaction, Canadian Solar issued a ¥6,200MM private placement to finance a 21MW portfolio of solar projects in Japan. The issuance was bought by one institutional investor.

Solar Project Bonds from Repeat Sponsors

Select sponsors who successfully executed solar financings in the Capital Markets, such as NextEra, Consolidated Edison, Canadian Solar and MidAmerican, have relied on Project Bonds for more than one of their projects.

This trend underlines the success of solar offerings since 2010 and the increased ease in executing such transactions, as market participants become more familiar with risks associated with solar projects.

Repeat Sponsor: Case Study #1

NextEra was one of the first issuers of solar Project Bonds, in 2011, with the \$702MM senior secured notes for the NextEra Genesis Solar project, a 250MW parabolic trough project. The same year, NextEra tapped the Capital Markets for Desert Sunlight, a 550MW PV project in California, with a \$744MM senior secured offering. This private placement was closed alongside a syndicated loan to finance the construction of the solar project.

In 2014, NextEra relied on a HoldCo offering on the back of the Genesis Solar project with the \$280MM HoldCo Project Bond issued by Genesis Solar Funding LLC, the owner of the project.

Repeat Sponsor: Case Study #2

Consolidated Edison sponsored its first project bond issuance in March 2013 with \$219MM in senior secured notes for a greenfield 1,100MW PV solar plant in the US. Since this inaugural issuance, Consolidated Edison has acted as project sponsor on three additional Project Bond issuances in December 2015, April 2016, and May 2016 for operating PV solar plant assets across the US. For each issuance, Consolidated Edison has relied on the 4(a)(2) US Private Placement market for its solar projects and each issuance has been well-received in this market by investors.

country risk. These particular aspects of the transaction do not necessarily prevent successful offerings but may require additional liquidity and credit enhancement.

Rating Agencies

Rating agencies approach solar financing by applying their generic project finance criteria complemented by solar-focused methodologies and commentary articles.

Rating agencies regularly update their methodologies as they rate new asset types and structures. For example, the development of various solar technologies has led to refined criteria by Fitch to specifically address the risks associated with CSP and CPV technologies. Their criteria also evolved based on the performance of rated transactions.

The table on the following page presents the main sizing criteria and structural features consistent with investment-grade ratings for Fitch, Standard and Poor's, Moody's, DBRS, and Kroll. Investment-grade offerings usually share the following main characteristics: PPA with investment-grade counterparties, fully amortizing profile over the PPA tenor, proven technology, exposure to construction risk, and experienced participants. Items that may constrain the rating to below-investment grade include inadequate performance of solar technology/design, exposure to merchant risk, sub-investment-grade counterparties, and

Rating Criteria for Investment-Grade Solar Offerings					
	Fitch	Standard & Poor's	Moody's	DBRS	Kroll
Applicable Methodologies and Select Research	<ul style="list-style-type: none"> "Rating Criteria for Infrastructure and Project Finance" (Sep 2015) "Rating Criteria for Solar Power Projects" (Mar 2016) 	<ul style="list-style-type: none"> "Project Finance Framework Methodology" (Sep 2014) "Project Finance Operations Methodology" (Sep 2014) "Approach to Rating Renewable Energy Project Finance Transactions" (Apr 2015) "Key Rating Factors for Power Project Financings" (Sep 2014) 	<ul style="list-style-type: none"> "Generic Project Finance Methodology" (Dec 2010) "Power Generation Projects" (Dec 2012) "PV Solar Power Generation Projects" (July 2010) 	<ul style="list-style-type: none"> "DBRS methodology Rating Project Finance" (August 2014) "Rating Solar Power Projects" (Dec 2015) 	<ul style="list-style-type: none"> "Project Finance Rating Methodology" (Nov 2013)
DSCR Indication for Investment Grade Rating	<ul style="list-style-type: none"> P90 (1-year) generation Additional specific adjustments to cash flows Min DSCR $\geq 1.30x$ for adjusted contracted cash flows (PV) Min DSCR $\geq 2.00x$ for adjusted merchant cash flows (PV) Min DSCR $\geq 1.40x$ for adjusted contracted cash flows (CSP) Min DSCR $\geq 2.50x$ for adjusted merchant cash flows (CSP) 	<ul style="list-style-type: none"> P90 (1-year) generation Min DSCR $\geq 1.40x$ for contracted cash flows Min DSCR $\geq 2.00x$ for merchant cash flows 	<ul style="list-style-type: none"> P90 (1-year) or P95 (1-year) generation Min DSCR $\geq 1.40x$ for contracted cash flows Min DSCR $\geq 3.50x$ for merchant cash flows 	<ul style="list-style-type: none"> P90 (1-year) generation Additional specific adjustments to cash flows Min DSCR $\geq 1.30x$ for adjusted contracted cash flows No exposure to merchant revenues 	<ul style="list-style-type: none"> Generation assumption not specified Min DSCR $\geq 1.30x$ for contracted cash flows
Base Case Assumptions and Adjustments	<ul style="list-style-type: none"> P50 generation Energy production haircut: 0% to 10% Grid curtailment adjustment (as informed by a third-party assessment) Availability: 92% to 98% (PV) Availability: 90% to 98% (CSP) Other adjustments may be applied on a case by case basis 	<ul style="list-style-type: none"> Inflation rate: 2% Degradation: 0.50% Availability: 94% to 98.5% O&M cost: increase of 5% to 10% over pro forma costs Other adjustments may be applied on a case by case basis 	<ul style="list-style-type: none"> No specific adjustments / assumptions specified for Base Case scenario Adjustments may be applied on a case by case basis 	<ul style="list-style-type: none"> No specific adjustments / assumptions specified for Base Case scenario Adjustments may be applied on a case by case basis 	<ul style="list-style-type: none"> No specific adjustments / assumptions specified for Base Case scenario Adjustments may be applied on a case by case basis
Other Structural Considerations	<ul style="list-style-type: none"> 6-month Debt Service Reserve Account 6-month Operation & Maintenance Account Distribution Test 	<ul style="list-style-type: none"> 6-month Debt Service Reserve Account 6-month Operation & Maintenance Account Distribution Test 	<ul style="list-style-type: none"> 6-month Debt Service Reserve Account 6-month Operation & Maintenance Account Distribution Test 	<ul style="list-style-type: none"> 6 to 12-month Debt Service Reserve Account 6 to 12-month Operation & Maintenance Account Distribution Test 12-month tail on PPA tenor 	<ul style="list-style-type: none"> 6 to 12-month Debt Service Reserve Account 6 to 12-month Operation & Maintenance Account Distribution Test

Source: Rating Agencies, CA CIB

Conclusion

Since 2010, the Capital Markets have welcomed solar Project Bonds for different technologies and geographies. An increasing number of sponsors, eager to expand their sources of liquidity for the development of utility-scale solar projects, continue to tap the Capital Markets. Investor appetite remains strong in North America and Europe, and recent successful transactions in Asia suggest that the horizon for solar Project Bond will continue to expand.

Project Bond Focus

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Solar Project Bonds												
Global issuances to date												
Issuer	Sponsor(s)	Capacity (MW)	Type	Technology	Project Status	Currency	Size (MM)	Tenor (Years)	WAL (Years)	Ratings at Issuance (Moody's / S&P / Fitch)	Coupon	Closing Date
TS Energy	Zhongli Talesun Solar	43	PV	Portfolio - Mix	Operating	EUR	40	16.0	--	--	4.200%	Aug-16
Canadian Solar Portfolio	Canadian Solar	21.2	PV	Canadian Solar	Greenfield	JPY	6,200	--	--	--	--	Aug-16
Grand Renewable Solar LP	CCLI, Samsung, & Six Nations	100	PV	Canadian Solar	Operating	CAD	613	19.0	9.6	BBB (DBRS)	3.926%	Jun-16
Vela Energy	Centerbridge Partners	100	PV	Portfolio - Mix	Operating	EUR	404	20.0	--	-- / BBB / --	3.195%	Jun-16
Solaria	--	10	PV	--	Operating	EUR	45	21.0	--	-- / BBB- / --	4.200%	May-16
ConEd California Holdings 3	Consolidated Edison	--	PV	--	Operating	USD	95	20.0	12.0	NAIC-2	4.070%	Apr-16
ConEdison Development	Consolidated Edison	106	PV	Mission Solar	Operating	USD	218	25.0	--	--	--	Mar-16
Aomori-Misawa	Canadian Solar	10	PV	--	Operating	JPY	3,000	20.0	--	A (Japan CRA)	1.400%	Mar-16
ConEdison Development	Consolidated Edison	45	PV	Mission Solar	Operating	USD	159	25.0	14.3	NAIC-2	4.530%	Dec-15
Etrion Solar PV Portfolio	Etrion	54	PV	Portfolio - Mix	Operating	EUR	35	14.0	--	--	Euribor + 225bps	Dec-15
Lightsource	Lightsource	101	PV	Portfolio - Mix	Operating	GBP	247	22.0	--	--	--	Nov-15
Lightsource	Lightsource	101	PV	Portfolio - Mix	Operating	GBP	37	8.0	--	--	--	Nov-15
Solaben 1 & 6	Abengoa	250	CSP	Abengoa Solar	Operating	EUR	285	19.0	10.0	-- / BBB / --	3.758%	Sep-15
Solar Star Funding	MidAmerican	579	PV	SunPower	Greenfield	USD	325	20.0	12.5	Baa3 / BBB / BBB-	3.950%	Mar-15
Antin Solar Investments	Antin Solar	66	PV	Portfolio - Mix	Operating	EUR	85	14.0	--	NR	--	Nov-14
Northland Power Solar Finance One LP	Northland Power	60	PV	SunEdison	Operating	CAD	232	18.0	9.3	BBB (high) DBRS	4.397%	Oct-14
Enerparc	Enerparc	52	PV	--	Operating	EUR	17	10.0	bullet	NR	4.750%	Jul-14
Genesis Solar Funding LLC	NextEra	250	CSP	Flabeg, Siemens, Schott	Operating	USD	280	24.0	13.0	NAIC-2 (BBB- Fitch)	5.600%	Jun-14
Borealis Canada Solar Portfolio	Recurrent	108	PV	Recurrent	Greenfield	USD	390	C + 19	--	--	--	Jan-14
CSolar	Tenaska	130	PV	First Solar	Operating	USD	316	25.0	12.0	NAIC-2	5.120%	Nov-13
Solar Star Funding	MidAmerican	579	PV	SunPower	Greenfield	USD	1,000	22.0	14.7	Baa3 / BBB- / BBB-	5.375%	Jun-13
Touwsrivier	Soitec	44	CSP	Soitec	Greenfield	ZAR	1,000	16.0		Baa2.za (Moody's)	11.000%	Apr-13
Topaz Solar Farms LLC	MidAmerican	586	PV	First Solar	Greenfield	USD	250	26.0	14.0	Baa2 / BBB / BBB	4.875%	Apr-13
Consolidated Edison	Consolidated Edison	1,100	PV	GCL Solar	Greenfield	USD	219	24.0	15.0	NAIC-2 (BBB+)	4.780%	Mar-13
Solar Power Generation	Solar Power Generation Ltd.	10	PV	--	Operating	GBP	40	24.0	--	--	3.610%	Nov-12
Imperial Valley Solar	AES	200	PV	AES Solar	Greenfield	USD	416	25.7	14.6	NAIC-2	6.000%	Nov-12
Centinela Solar Energy Project	LS Power	170	PV	Yingli	Greenfield	USD	275	22.0	--	--	5.600% (fixed) / 5.800% (delayed)	Oct-12
St. Clair Holding	NextEra	40	PV	First Solar	Operating	CAD	172	19.0	10.0	BBB (DBRS)	4.880%	Sep-12
Topaz Solar Farms LLC	MidAmerican	550	PV	First Solar	Greenfield	USD	850	28.0	15.5	Baa3 / BBB- / BBB-	5.750%	Feb-12
Desert Sunlight	NextEra / GE	550	PV	First Solar	Greenfield	USD	744	25.0	17.7	Both by Fitch: AAA (DOE Backed) / BBB- (Uncovered)	5.506%	Aug-11
NextEra Genesis Solar	NextEra	250	CSP	Flabeg, Siemens, Schott	Greenfield	USD	702	26.5	12.5	Both by Fitch: AAA (DOE Backed) / A- (Uncovered)	3.875%	Aug-11
Andromeda Finance	SunPower	51	PV	SunPower	Greenfield	EUR	98	18.0	--	Baa3 / -- / --	4.839%	Dec-10
Andromeda Finance	SunPower	51	PV	SunPower	Greenfield	EUR	98	18.0	--	Aa2 / -- / --	5.715%	Dec-10

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