Assessing the Potential for US Utility Green Bonds

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Executive Summary

Bonds are the largest single class of financial instrument across the world's financial markets. Recently, a subclass of these bonds, called *green bonds*, has emerged in the market place. Green bonds are a type of bond whose proceeds may be used only for certain approved "green" investments. In exchange for agreeing to invest only in such projects, the bond issuer obtains some value greater than they would obtain from traditional financing, and are therefore encouraged to finance and undertake a greater number of green projects. This unique value may not be recognized in traditional financial accounting. Of course, like any other capital-raising investment, green bonds enable their issuer to finance a new project that should increase (or at least maintain) its revenues, profits, and cash flow.

The utility sector was the second largest issuer of green bonds in 2017, accounting for \$26.2 billion dollars' worth of green bond issuance globally. These were primarily issued to finance renewable energy projects, a class of projects that makes the utility sector one of the most logical for deployment of green bonds.

While choosing to issue green bonds does not seem to have any price advantage over regular bonds in the market, green bonds can provide other benefits. These benefits may include reputation effects, better treatment in secondary markets, and other intangibles (See Table ES-1).

Perceived Advantage	Discussion
Strategic signaling	Willingness to adhere to GBPs signals utility's
	commitment to strategy of green
	transformation to marketplace
Benefits in Down Market	Some experts believe that price of Green
	Bonds will decline less in a down market
Benefits in Secondary Market	Some experts think that Green Bonds will
	trade more easily or at higher prices in
	secondary market
Investor Diversification	Allow access to new investors with
	environment investment criteria
Benefits to Other Issuance	Some experts postulate that a "halo effect"
	will convey some of the indirect value
	created by Green Bonds to other issuances.

Table ES-1: Green Bonds' Reported Indirect Financial Advantages

Green bonds allow investors to participate in environmentally and socially responsible projects and obtain greater transparency into the effects of the bonds they purchase. There is also some evidence that green bonds carry a lower risk than regular bonds: a study by Moody's Investment Services – one of the leading credit rating agencies – found that loans for green projects had a 10-year cumulative default rate of 5.7% versus a rate of 8.5% for non-green projects.

Given the potential upside of issuing green bonds, what is the capacity of electric utilities in the U.S. to issue more debt? We took a conservative approach to assessing the potential for utilities to issue new green bonds by examining utilities' ability to issue added debt without changing its

bond rating. The additional debt capacity is then the added debt that could be issued while maintaining its current credit rating under the conservative assumption that the new debt does not change regulatory, financial or market conditions other than a small increase in cash flows enabled by the project financed with the bonds.

Our calculation of green bond capacity is based on the analytic framework used by Moody's bond rating agency. We take several current utilities and determine the upper limit of their debt levels that would maintain their current credit ratings. We then repeat this entire exercise for the U.S. utility sector, treating it as if it were one large aggregate company. We do not consider additional debt that is scheduled to be refinanced in our calculation, adding another conservatism.

Moody's methodology uses four financial ratios to determine the financial strength factor in its calculation of green bonds. These are:

- Cash Flow from Operations Before Changes in Working Capital plus Interest Payment divided by Interest Payment (CFO pre-WC + Interest/Interest)
- Cash Flow from Operations Before Changes in Working Capital divided by Total Debt (CFO pre-WC/Debt)
- Cash Flow from Operations Before Changes in Working Capital minus Dividends
 Payment divided by Total Debt (CFO pre-WC dividends /Debt); and
- Total Debt divided by Total Capitalization. (Debt/Capitalization)

We use these ratios to calculate the upper allowable range of debt for utilities in their current rating class.

Using the sector's current financial ratios, Moody's rating limits, and our modeling approach, the total debt capacity above the current level of indebtedness for the Utility sector is **\$261 billion.** In our discussion with Moody's representatives, however, they suggested using only the two most important ratios, CFO pre-WC / Debt and CFO pre-WC – Dividends / Debt. With all other calculations unchanged, using just two ratios with the new limits give us a green bond capacity of **\$438 billion**. We believe these numbers provide a conservative, indicative range of

the US industry's potential capacity to issue added green bonds – a capacity in the range of one third to one-half trillion dollars.

Green bonds are a new financial instrument that has become increasingly popular in the recent years. By issuing green bonds, firms can take advantage of the good public image for the "green" use of proceeds, more easily meet their financing target as demand is high, and, as historical data suggested, enjoy a lower default rate.

The worldwide utility sector is one of the top issuers of green bonds, yet in the US utilities are not yet very active in issuing green bonds. One explanation is that, although utilities carry out many projects that are eligible to be financed by issuing green bonds, they are discouraged by added reporting requirements and limits of the use of proceeds (both described in more detail in the main report below). A second reason can be the current low interest rate environment where conventional debt financing is safe and easy to raise, giving a firm less motivation to change its current debt financial instrument. However, soon firms will have to take a more careful look at their debt issuance as the Fed raises interest rates and the global economy enters a general slowdown. Regardless of the state of the economy or the specific pros and cons of green bonds in the eyes of utilities, it is clear that the US industry has the capacity to issue at least \$250 to \$500 billion green bonds, especially if they contribute to new revenues and cash flow.

1. Introduction and Purpose

Across the world's financial markets, the securities known as bonds are the largest single class of financial instruments. According to SIFMA (2018), the total balance of bonds outstanding in the US market alone is about \$41.6 trillion, including \$3.8 trillion of municipal bonds, \$14.9 trillion of treasury bonds and \$9 trillion of corporate bond. As of October 2018, 29 top U.S. utilities have about \$375 billion of bonds outstanding (S&P 500[®] Utilities Corporate Bond Index, n.d.). In comparison, the total market capitalization of the Russell 3000 Index – the index containing 98.5% of the US stock market cap - only reached nearly \$30 trillion in Jan 2018 (Racanelli, 2018).

Within the class of debt securities there is a relatively new type of bond known as *green bond (GB).* As explained further below, green bonds are a type of bond that may be used only for certain approved "green" investments. The central idea underlying the green bond concept is that, in exchange for agreeing to invest only in green projects the bond issuer will obtain some value greater than they would have obtained from traditional financing, and are therefore encouraged to do finance and undertake a greater number of green projects. The value obtained by the green bond issuer could come in the form of lower financing costs, higher financing capacity, an improved reputation or higher ratings on ESG criteria, higher company value, or other sources.¹ Green bonds also allow issuers to diversify their investor base.

Another bond instrument that is similar to Green Bonds is called "Social Bonds." Social Bonds are bonds whose proceeds are applied to finance or re-finance, in part or in full, new and/or existing eligible Social Projects (defined in the Social Bonds Principles - SBP) and which are aligned with the four core components of the SBP. (ICMA Paris Representative Office, 2018)

According the SBP, certain Social Projects may also have environmental co-benefits, and the classification of a use of proceeds as a Social Bond should be determined by the issuer based on its primary objectives for the underlying projects.

¹ See Section III below for further discussion of the costs and benefits of green bonds.

Bonds that intentionally mix green and social projects are referred to as Sustainability Bonds. There is specific guidance for these provided separately in the Sustainability Bond Guidelines. (ICMA Paris Representative Office, 2018) While much of the discussion in the report may apply to social or sustainability bonds, our formal focus is strictly limited to GBs.

Billions of dollars of green bonds have already been issued by governments, companies, and energy utilities. However, every government and industry faces limits on the amount of new debt it can issue, regardless of the use of borrowed proceeds. The purpose of this report is to assess the approximate financial capacity of U.S. electric utilities to issue additional green bonds for approved purposes. In addition to determining the dollar magnitude of the potential, we briefly examine U.S. utilities' experience with green bonds to date and the likely issues and challenges with utility green bonds going forward.

2. Green Bonds: Definition and Background

Definition and Principles

There is no binding, legal standard unique to green bonds. At present, they are rated by the rating agencies like all other bonds. Much like renewable energy certificates, green bonds are self-identified by issuers who pledge to adhere to voluntary principles promulgated and overseen by NGOs rather than national securities regulators. One of the leading trade associations to issue such guidelines is the International Capital Market Association (ICMA). ICMA has set out the Green Bond Principles (GBPs) – "voluntary process guidelines that recommend transparency and disclosure and promote integrity in the development of the green bond market by clarifying the approach for issuance of a green bond" (ICMA Paris Representative Office, 2018).

The ICMA's Green Bond Principles contains four main criteria for labeling a bond a valid green bond:

(1) **Use of Proceeds.** The proceeds received from green bond financings must be used for specifically identified projects each dedicated to a specific approved

purpose. The types of projects eligible for funding via green bonds are ((ICMA Paris Representative Office, 2018):

 Renewable energy (including production, transmission, appliances and products);

• Energy efficiency (such as in new and refurbished buildings, energy storage, district heating, smart grids, appliances and products);

 Pollution prevention and control (including reduction of air emissions, greenhouse gas control, soil remediation, waste prevention, waste reduction, waste recycling and energy/emission-efficient waste to energy);

• Environmentally sustainable management of living natural resources and land use (including environmentally sustainable agriculture; environmentally sustainable animal husbandry; climate smart farm inputs such as biological crop protection or drip-irrigation; environmentally sustainable fishery and aquaculture; environmentally-sustainable forestry, including afforestation or reforestation, and preservation or restoration of natural landscapes);

• Terrestrial and aquatic biodiversity conservation (including the protection of coastal, marine and watershed environments);

• Clean transportation (such as electric, hybrid, public, rail, nonmotorised, multi-modal transportation, infrastructure for clean energy vehicles and reduction of harmful emissions);

 Sustainable water and wastewater management (including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training and other forms of flooding mitigation);

• Climate change adaptation (including information support systems, such as climate observation and early warning systems);

 Eco-efficient and/or circular economy adapted products, production technologies and processes (such as development and introduction of environmentally sustainable products, with an eco-label or environmental certification, resource-efficient packaging and distribution); and

• Green buildings which meet regional, national or internationally recognized standards or certifications

- (2) The Process for Project Evaluation and Selection. According to the ICMA Principles, "the green bond issuer should have a clear communication to investors regarding the environmental sustainability objective, the process by which the issuer determines how the projects fit within the eligible Green Projects categories identified above." The Principles also call for transparency regarding eligibility and selection criteria and "any other process applied to identify and manage potentially material environmental and social risks associated with the projects."
- (3) The Management of Proceeds. The Principles call for the separate tracking of the use of proceeds in dedicated financial accounts that are professionally audited, and that the performance of the project on all key metrics be tracked; and
- (4) **Reporting.** The results of the green bond proceeds financial and performance audits should be made transparent to all stakeholders.

These Principles impose significant, if voluntary, obligations on the issuers of green bonds. They must use the proceeds only for specific, approved projects; they must segregate and separately track the spending of proceeds on these projects; and they must engage in extra evaluation and reporting activities. In exchange for adopting these limitations and incurring the associated added costs, the issuers gain benefits in a variety of forms described below.²

Growth of the Global Green Bond Market

While it is difficult to quantify the cost/benefit picture from the standpoint of the issuer, it is clear that the green bond market has provided enough benefits to stimulate extremely strong growth.

The first issuance to the market was in 2007, when multilateral agencies the European Investment Bank and the World Bank pioneered an AAA-rated bond aimed at assisting governments with achieving their goals in climate change policy. In March 2013, the first \$1 billion green bond was sold within an hour of its release by the International Finance Corporation, a World Bank Group member. Since then, according to the Climate Bonds Initiative (https://www.climatebonds.net/), issuance has climbed steadily, reaching \$37 Billion in 2014 and \$155.5 billion in 2017, surpassing even the Initiative's own forecasts. The US was the largest issuer in 2017, with more than \$40 billion bonds issued. Its Agency Fannie Mae was also the top issuer with \$23.9 billion of Green MBS. The US, together with China and France, account for 56% of 2017 issuances. In China, banks dominate with 74% of issuance while in France, the French sovereign bond was the major contributor. All issuers came from 37 countries with ten new entrants including Nigeria, Fiji, Malaysia, Argentina, UAE, Lithuania and Switzerland. Emerging market issuance is also growing fast (Climate Bonds Initiative, 2018, p. 1).

Green Bond Industry Sectors and Utility Green Bonds Worldwide

Utilities are logical issuers of green bonds, but they are joined by many other industries and issuers in today's green bond marketplace. According to UniCredit, an Italian giant in banking and financial services, the utility sector was the second largest issuer of green bonds in 2017. Of the total \$119 billion of green bonds issued in 2017 (UniCredit excluded the Fannie Mae

² One of our expert reviewer, James Hempstead of Moody's, notes that the added reporting requirement burdens are not large.

Green MBS issues in their report because the issues "would distort issuance history"), the utility sector accounted for 22% or \$26.2 billion. There are 4 utilities with green hybrid bonds (hybrid bonds generally have both debt and equity characteristics, i.e. convertible bond can be converted into stock) including Tenner, Iberdrola, Orsted and most recently in 2018 Engie. Innogy was the first German utility to issue green bonds and others may follow suit in 2018 (UniCredit Bank AG, 2018, p. 2).



Figure 1: green bond issuance value in segments

As for the US utility segment, companies issued green bonds mostly to finance renewable energy projects, which are aligned with the strategy of many in moving to a cleaner portfolio. There is no central data source for all green bonds that were issued by utilities in the US. However, we were able to identify some of the notable issuances within the last few years from different sources and combine them into the table below.

Source: (UniCredit Bank AG, 2018, p. 10).³

³ "Supras" stands for supranational entities – formed by two or more central governments with the goal of improving economic for the member countries, e.g. Europe Investment Bank, World Bank, etc.

Date Issued	Company	Amount	Projects
			Eligible renewable energy projects including solar
			and wind facilities:
			- Solar Gen 2 Solar Facility
	Southern		- Decatur Parkway Solar Facility
Nov-15	Power	\$1 billion	- Kay Wind Facility
			Georgia Power intends to allocate the net
			proceeds of the offering primarily to renewable
			energy generation projects with any remaining
			net proceeds allocated to electric vehicle
			charging infrastructure or payments under power
	Georgia		purchase agreements served by solar power or
Mar-16	Power	\$325 million	wind power generation facilities
			Issued in Europe. Eligible renewable energy
			projects including solar and wind facilities:
			- Desert Stateline Solar Facility
			- Decatur Parkway Solar Facility
	Southern		- Pawpaw Solar Facility
Jun-16	Power	\$1.2 billion	- Passadumkeag Windpark
			The green bond funds will be used for
			investments in certain renewable energy
			generation projects ("Eligible Green Projects"),
	Westar		primarily for the construction of the Western
Jun-16	Energy	\$350 million	Plains Wind Farm

Table 1: Green Bonds Issuance by American Electric Utilities

			Eligible renewable energy projects including solar
			and wind facilities:
			- Boulder Solar I Facility
			- Grant Wind Facility
	Southern		- Grant Plains Wind Facility
Nov-16	Power	\$900 million	- Wake Wind Energy Center
			Middmonian Framerican of COTE million of 10
			WidAmerican Energy Issued \$375 million of 10-
			year green bonds and \$475 million of 30-year
			green bonds, totaling \$850 million of green bonds
	MidAmerican		to fixed-income investors to finance a portion of
Feb-17	Energy	\$850 million	the Wind X and Wind XI projects
			MidAmerican Energy issued \$700 million of 30-
			vear green honds to fixed-income investors to
	MidAmorican		finance a partian of the Wind VI and wind
5 4 40			
Feb-18	Energy	\$700 million	repowering projects.
			Fund the development and construction of solar
			arrays and wind farms, including the
			transmission infrastructure to support renewable
			energy facilities
			Strengthen energy efficiency programs to
			help Michigan residents and businesses save
May-18	DTE	\$525 million	energy and reduce bills
	Interstate		Renewable energy generation projects, including
	Power & Light		wind and solar, that will be owned and operated
Sep-18	Company	\$500 million	by IPL

	(Alliant		
	Energy)		
			Finance eligible green energy projects – including
	Duke Energy		zero-carbon solar and energy storage – in North
Nov-18	Carolinas	\$1 billion	and South Carolina.
			The proceeds from the \$362 million privately
			placed notes were used to reimburse Dominion
			Energy for previously deployed capital related to
			the acquisition, development, and construction of
			20 merchant solar projects placed in service
	Dominion		between 2016 and 2018, all of which enjoy long-
Nov-18	Energy	\$362 million	term PPAs.
			MidAmerican Energy issued \$600 million of 10-
			year green bonds and \$900 million of 30-year
			green bonds, totaling \$1,500 million of green
			bonds to fixed-income investors to finance a
	MidAmerican		portion of the Wind XI, Wind XII and repowering
Jan-19	Energy	\$1.5 billion	projects.

Source: (Southern Company, n.d.) (Cision PR Newswire, 2016) (Cision PR Newswire, 2018) (Dominion Energy, 2018) (Duke Energy, 2018) (Westar Energy, 2016) (MidAmerican Energy , 2019) (Alliant Energy, n.d.)

Renewable energy is listed as one of eligible projects for green bonds as defined by the Climate Bonds Initiative. Surely, with such criteria many of the renewable projects US utilities are implementing qualify as eligible to be financed by green bonds. And yet, if we look at the table, the dollar amount of green bonds issued by US utilities seems to not amount to much even when compared to the \$375 billion of utility bonds outstanding from the S&P 500 Utilities Corporate Bond Index.

3. Green Bonds' Advantages and Disadvantages

Like all other financial instruments, green bonds have their own particular pro's and con's. While their positive attributes clearly outweigh the negative, we first mention some disadvantages before turning to Green Bonds' strengths.

We note that there are some disadvantages and cost of green bonds as they have drawn some criticism. The most common complaint heard concerning green bond is that they are a form of 'greenwashing' – an effort to mislead customers about the environmental benefits of certain products, projects or policies through the advertising of unsubstantiated claims. For example, Assaad Wajdi Razzouk, a Lebanese-British clean energy entrepreneur, claims that countries such as Indonesia and Poland have issued green bonds while their deforestation is still going strong. He believes that there is no "consistent definition of what is 'green', which suits the market very well: Everyone from oil companies to banks are piling in with questionable deals. It must be incredibly convenient for corporations and sovereign issuers that money is fungible by its very nature, and therefore no one knows where it's really going." (Razzouk, 2018) As the Green Bond Principles remain a voluntary framework, continued monitoring and independent assessment of green bonds remain an essential part of their continued use as a legitimate climate strategy.⁴ The other disadvantage often cited regarding Green Bonds is that they provided no value, yet prompt costs related to tracking and reporting the use of proceeds.

The objection that Green Bonds do not command higher issue prices than equivalent non-green bonds does seem to be supported by current empirical research. According to Bloomberg, based on the current available data on the market, issuers do not seem to obtain any price advantage from green bond offerings (Bloomberg Intelligence, 2018). The website climatebonds.net states on their green bond explanation page that "green bonds are *pari pasu* as other vanilla bonds from the same issuer" (Climate Bonds Initiative, n.d.). However, there

⁴ There is encouraging progress on increased transparency regarding the environmental impacts of green bonds as well as ESG investments generally. See, for example, Green Bonds – *What's Inside the Black Box with the Green Label? Antje Schneeweiß, SÜDWIND e.V., June 2015,* available at https://www.researchgate.net/publication/313421222_

does appear to be many forms of indirect value creation. Table 2 provides an overview of the reported sources of indirect benefits.

Perceived Advantage	Discussion
Strategic signaling	Willingness to adhere to GBPs signals utility's
	commitment to strategy of green
	transformation to marketplace
Benefits in Down Market	Some expects postulate that price of Green
	Bonds will decline less in a down market
Benefits in Secondary Market	Some experts postulate that Green Bonds
	will track more easily or at higher prices in
	secondary market
Investor Diversification	Allow access to new investors with
	environment investment criteria ⁵
Benefits to Other Issuance	Some experts postulate that a "halo effect"
	will convey some of the indirect value
	created by GBs to other issuances.

Table 2: Green Bonds' Reported Indirect Financial Advantages

'Strategic Signaling' is the first possible advantage. This means that issuance of green bonds supposedly signals that an organization is committed to strategy of green transformation in the market place. Similarly, a research paper by Caroline Flammer at Boston University claimed "green bonds provide a credible signal of the companies' commitment to the natural environment and help attract an investor clientele that values green projects". The paper also

⁵ These advantages have not yet been proven in published empirical studies.

suggested that green bonds yield positive announcement returns improvements in long-term value and operating performance, improvements in environmental performance, increases in green innovations, and an increase in ownership by long-term and green investors (Flammer, 2018).

Green Bonds are also believed to be more easily traded between investors in down markets and secondary markets. A report published by Barclays in 2015 found that together with the fast growth of green bonds over the previous years, the secondary market saw investors pay a premium to acquire green bonds. In particular, Barclays' model suggested that there was an approximately 20 basis points difference between the spread of green bonds and comparable issues, and was due partly to opportunistic pricing based on strong demand from environmentally focused funds. (Preclaw & Bakshi, 2015)

As for Investor Diversification, Climatebonds.net believes that one of the reasons for this is that investors are more and more focused on integrating Environment, Social and Governance (ESG) factors into their investment processes, a goal for which green bonds can be a useful tool. In particular, investors can benefit from green bonds relative to traditional bonds because they are able to fund green projects without taking on project risk, see greater transparency into a bond's use of proceeds, meet commitments as signatories of Principle for Responsible Investment (PRI) and The Institutional Investors Group on Climate Change (IIGC) (Climate Bonds Initiative , n.d.).

In early 2018, GreenBiz mentioned an analysis by NatWest Markets suggesting that beside the "green" advantages, the expansion of green bonds also can encourage and make sustainable thinking in financial market more general, helping to promote climate change awareness. NatWest calls this the "halo effect" of a green bond, claiming that an issuance would put a positive luster on a bank's, government's, or company's other bond offerings. "Our interpretation of this effect is that green bond issuance helps attract a broader sustainability-focused investor base to the company's debt as a whole", Natwest stated, "thereby putting downward pressure on the entire curve". (Holder, 2018). Natwest's methodology for isolating

the so called halo effect has been questioned, and has not yet been demonstrated empirically. However, this anecdotal discussion highlights the possibility that green bonds are "appealing to powerful forces within the financial system." (Hale, 2018)

In addition, there is some evidence that green bonds could carry lower risk than average corporate issues if they follow the risk profile of green project loans. An in-depth study carried out by Moody's in 2018 on 5,859 "infrastructure basket" projects in the 1983-2016 period found that green use-of-proceeds project finance bank loans had a lower default rate than non-green use-of-proceeds project loans in their selected sample. Within their sample, the loan for green projects'10- year cumulative default rate (Basel II) is 5.7%, comparing to a rate of 8.5% for non-green projects.⁶ (Moody's Investor Service, 2018). While this study examined loans rather than bonds, it is possible that the similar affect also applies to Green Bonds.

4. The Financial Capacity to Issue More Utility Debt

Our Computational Framework Takes a Highly Conservative Approach

What constrains an electric utility from issuing more debt? Obviously, regulated utilities must get permission to issue debt and must maintain specified debt-equity ratios. More broadly, greater debt issuance makes a firm riskier, lowering the credit rating of the issuer and that issuer's bonds and lowering the price of the bond (i.e. raising its interest rate).

However, suppose a utility issues a bond – with matching equity, if necessary – that enables it to increase its revenues and earnings so as to maintain or improve its financial performance. In theory, there is no limit on a utility's issuance of this type of bond – the limit is only the ability of the utility to grow profitably.

For individual utilities and for the U.S. sector as a whole, we cannot evaluate the potential to issue new debt that will add incremental earnings and cash flow above current levels. However, there is no constraint on utilities' ability to issue new debt and equity (within current regulatory

⁶ Moody's notes that their sample may not be representative of future issues due to some unexplained results in a third category of bonds in their sample, undetermined used of proceeds.

rules and legal structures) if growth opportunities are there, so there should not be large untapped opportunities to expand utilities' capital base.

In view of all this, our approach to assessing the potential for utilities to issue new green bonds is to examine their ability to issue added debt that finances additional approved green bond projects without changing any other aspect of the company's financial performance or operations. The utility's management, regulatory situation, and all other planned investments and operations continue as forecasted, but the utility issues green bonds to finance additional facilities and projects not currently in its plans. The potential for added green bonds is further defined as the amount of added debt that could be issued under these "ceteris paribus" conditions *while maintaining its current credit rating under the conservative assumption that the new debt improve free cash flows only slightly and does not affect any other metrics of financial performance.* As an added conservatism, we use a single financial ratio trigger, as explained below.

This is a conservative approach to creating an estimate for added green bond capacity. We use conservative measures of financial indicators that limit a utility's ability to issue debt. Our entire approach amounts to creating what should be a lower bound to the amount that could be issued. In effect, we estimate the amount of debt a utility could issue and still maintain its current credit rating when that debt went to approved green projects, and these projects add only five cents of additional cash flow to every dollar of green bond principal. It is possible that issuance of a green bond would not add any additional cash flow, but in general we believe this is a conservative assumption.

The implementation of this conservative approach proceeds in these three steps. First, we copy the basic analytic framework used by Moody's bond rating agency to determine the potential size of a utility's debt in each credit rating category. Second, we take some current large utilities, place them in this framework, and then experiment with increases in their debt levels until the metrics that determine their credit ratings reach critical thresholds, with no other changes to each utilities' financial model or performance. When a threshold level that could trigger a credit downgrade is reached, we call the level of added debt needed to reach this

threshold the added green bond potential for this utility. Finally, we repeat this exercise for the entire U.S. utility sector, treating it as if it was one aggregated large company.

Beyond the fact that this should be a lower bound, several additional facets of this calculation should be noted. First, we are calculating an added capacity for any type of utility secured debt, not just green bonds. This added debt can be green bonds only if the utility agrees to the Green Bond Principles. Second, there is additional utility debt that comes up each year for refinancing. Again being conservative, we do not consider this eligible for green bond financing even though in some cases may be possible. Finally, in addition to the ceteris paribus framework discussed above, our calculation relies on many specific assumptions. For example, we assume that all new utility debt (whether green bond or not) would have an interest rate of 4.3%. Our full list of assumptions is described below.

Moody's Approach to Rating Utility Bonds

Investors in fixed income market make their investing decision on different factors, one of which is the issuer's credit rating. The credit rating in the bond market represents the credit worthiness of the corporate or government that issues bonds. The ratings are often used to assess the likelihood the debt will be repaid. Major credit agencies including Moody's, Standard and Poor and Fitch provide rating services for a fee.

Moody's – one of the world's leading firms in credit assessment – sets out four key factors that are important in the credit ratings of the regulated electric and gas utility sectors: The Regulatory Framework, the Ability to Recover Costs and Earn Returns, Diversification and Financial Strength. Moody's notes that these factors are "not intended to be an exhaustive discussion of all factors that our analysts consider in assigning ratings in this sector" (Haggarty, 2017), but they are widely acknowledged as four key factors in any utility credit assessment. Appendix I lists these factors in more detail. We do not evaluate or further discuss the first three of Moody's four factors (Regulated Framework, Ability to Recover Cost and Earn Returns, Diversification) in this report. This is equivalent to assuming that added utility issuance of green bonds would not weaken Moody's (or any other rating agencies) assessment of these three

factors. We think this is a reasonable assumption overall. There may be instances in which the issuance of green bonds reduces regulatory support or hurt cash flow diversification, but we also think there will be instances where green bonds help these factors as well.

With respect to financial criteria, Moody's approach is to (a) define several critical financial ratios that inform its assessment; and (b) set our ranges in which these indicators can fall in order for the utility to deserve a certain credit rating for an issuance (on overall).

Figure 2: Moody's credit rating scale explanation.

Global Long-Term Rating Scale

Aaa Obligations rated Aaa are judged to be of the highest quality, subject to the lowest level of credit risk.

- Aa Obligations rated Aa are judged to be of high quality and are subject to very low credit risk.
- A Obligations rated A are judged to be upper-medium grade and are subject to low credit risk.
- Baa Obligations rated Baa are judged to be medium-grade and subject to moderate credit risk and as such may possess certain speculative characteristics.
- Ba Obligations rated Ba are judged to be speculative and are subject to substantial credit risk.
- B Obligations rated B are considered speculative and are subject to high credit risk.
- Caa Obligations rated Caa are judged to be speculative of poor standing and are subject to very high credit risk.
- Ca Obligations rated Ca are highly speculative and are likely in, or very near, default, with some prospect of recovery of principal and interest.
- C Obligations rated C are the lowest rated and are typically in default, with little prospect for recovery of principal or interest.

Note: Moody's appends numerical modifiers 1, 2, and 3 to each generic rating classification from Aa through Caa. The modifier 1 indicates that the obligation ranks in the higher end of its generic rating category; the modifier 2 indicates a mid-range ranking; and the modifier 3 indicates a ranking in the lower end of that generic rating category. Additionally, a "(hyb)" indicator is appended to all ratings of hybrid securities issued by banks, insurers, finance companies, and securities firms.*

Note: For more information on long-term ratings assigned to obligations in default, please see the definition "Long-Term Credit Ratings for Defaulted or Impaired Securities" in the Other Definitions section of this publication.

* By their terms, hybrid securities allow for the omission of scheduled dividends, interest, or principal payments, which can potentially result in impairment if such an omission occurs. Hybrid securities may also be subject to contractually allowable write- downs of principal that could result in impairment. Together with the hybrid indicator, the long-term obligation rating assigned to a hybrid security is an expression of the relative credit risk associated with that security.

Source: (Moody's Investor Service, 2018)

As explained more fully in the next section, our approach is to place these financial metrics into a spreadsheet that shows how they change as hypothetically added green bonds are issued. When a level of added green bonds cause any of the financial ratios to reach a level that brings

the utility outside the range that ratio must be in to preserve the current credit rating we label this the conservative lower limit of green bond Potential.

5. Additional Utility Debt Capacity for Green Bonds

According to Moody's, the Finance Strength Factor is made from four distinct financial ratios, including:

- Cash Flow from Operations Before Changes in Working Capital plus Interest Payment divided by Interest Payment (CFO pre-WC + Interest/Interest)
- Cash Flow from Operations Before Changes in Working Capital divided by Total Debt (CFO pre-WC/Debt)
- Cash Flow from Operations Before Changes in Working Capital minus Dividends
 Payment divided by Total Debt (CFO pre-WC dividends /Debt); and
- Total Debt divided by Total Capitalization. (Debt/Capitalization)

Further definition of these financial ratios can be found in Appendix 1.

Each of these ratios has a specific allowable range for utilities in each rating class, as shown in Table 2 below. For example, the first financial ratio in the leftmost column is cash flow from operations before changes in working capital plus interest divided by interest. Utilities rated Aaa (third column from left) are expected to have financial results such that this ratio is eight or larger (>= 8x over the ratings period).

This table stands at the core of our approach to a conservative estimation of additional debt capacity. Every utility, and the sector as a whole, has already been rated, and stands within one of the rating categories shown across the top of the table. The financial ratios for each such utility currently fall into the ranges shown under that rating category's column on the table. To estimate added debt capacity, we use a simple financial model that adds hypothetical new debt to that utility's balance sheet.⁷ As this debt is added, interest payments increase.⁸ We also assume that each dollar of debt allows the utility to generate an additional 10 cents in Cash

 ⁷ A read-only, open-source version of this model will be posted on the ISE's website along with this report.
 ⁸ For all utilities, we e assume that all new debt will be issued at the current yield on Baa utility bonds, which is 4.7%. Interest payments are calculated based on this yield.

Flow from Operations. Together these changes affect the four financial ratios in the table in different ways. For example, the final ratio (Debt/Capitalization) is affected by adding the new debt to both the numerator and denominator of this ratio and recalculating.

For any one utility or the sector as a whole, our model continues to add new debt until any one of the four financial ratios reaches the threshold that would trigger a change in rating category. We call the total debt added between current levels and the level that triggers a rating change the (conservative) level of new green bond potential.

Factor 4: Financial Strength									
Weighting 40%	Sub-Factor Welghting		Aaa	Aa	A	Baa	Ba	в	Caa
CFO pre-WC + Interest / Interest	7.5%		≥ 8x	6x - 8x	4.5x - 6x	3x - 4.5x	2x - 3x	1x - 2x	< 1x
CFO pre-WC / Debt	15%	Standard Grid	≥ 40%	30% - 40%	22% - 30%	13% - 22%	5% - 13%	1% - 5%	< 1%
		Low Business Risk Grid	≥ 38%	27% - 38%	19% - 27%	11% - 19%	5% - 11%	1% - 5%	< 1%
CFO pre-WC - Dividends / Debt	10%	Standard Grid	≥ 35%	25% - 35%	17% - 25%	9% - 17%	0% - 9%	(5%) - 0%	< (5%)
		Low Business Risk Grid	≥ 34%	23% - 34%	15% - 23%	7% - 15%	0% - 7%	(5%) - 0%	< (5%)
Debt / Capitalization	7.5%	Standard Grid	< 25%	25% - 35%	35% - 45%	45% - 55%	55% - 65%	65% - 75%	≥ 75%
		Low Business Risk Grid	< 29%	29% - 40%	40% - 50%	50% - 59%	59% - 67%	67% - 75%	≥ 75%

Table 2: Moody's Financial Strength Assessment Grid.

Source: (Haggarty, 2017, p. 34)

To illustrate our approach, we pick Duke Energy Corporation to work on as an example. For the first financial ratio, row 2 of Table 3 shows that Duke's current ratio for CFO pre-WC + interest/interest is 4.6. (column 2). Column four shows that ratios below 4.5 could trigger a new rating category. Column five shows that our model estimates that Duke could issue \$3.370 billion in added bonds before its ratio falls to 4.5, leaving it with a total debt level of \$54 billion (column six). Other financial ratios, each examined in isolation, yield different incremental capacities. Duke's pre-WC / Debt ratio is 15%, (the third row of Table 3), which is in the Baa range. Our model estimates that the maximum added debt Duke can issue without this ratio falling below 13% is \$29.37 billion, shown in Column (5). Each of the four factors implies leads to a different maximum level of new debt before triggering a possible downgrade; we select the *smallest* of the incremental levels that leads to one ratio exceeding a threshold as our

conservative measure of additional debt capacity. One important point to note is, when the new debts change both the numerator and denominator of a ratio such that this ratio is never binding, we list that ratio in the table as "N.A". In the case of Duke, the first ratio we examined (CFO pre-WC + interest/interest) yields the binding constraint and we treat Duke's capacity to issued added green bonds as \$3.37 billion.

In our discussions with experts at Moody's, they reminded us that this approach is much more mechanistic than their actual ratings methods. They noted that there are factors other than these financial ratios to consider that these ratios were not absolute and immediate bright lines for ratings; and that, in many cases, the *changes* or *trends* in these ratios (which we do not model) is as important as the absolute levels. Furthermore, they note that we are not including any refinancing of existing debt to be eligible for green bond financing – which would add another \$2.7 billion of potential green bonds for Duke alone.⁹ Nonetheless, Moody's experts did agree that our calculation was a reasonable approach to estimating an approximate lower bound – one that could probably be exceeded by most utilities, but by amounts that would be somewhat situation-specific.

⁹ We assume that the average bond matures in 20 years, and that financings have been roughly even across the years, so that each year a utility would need to refinance one twentieth of its outstanding debts. As the debt outstanding of Duke in June 2018 is \$55,771 million, the estimated amount of debt that must be refinanced is roughly estimated as \$2,789 million. However, we think it is unlikely that these refinancings can be assumed applicable to use-of-proceeds that meet the Green Bond Principles, so we conservatively exclude them from our estimates.

Table 3: Duke's Debt Capacity Calculation (in \$million)

		Credit			
	LTM June	rating for	Downward Limit	Additional	Total Debt
Duke - Baa1	2018	ratio	at Rating	Debt at limit	at limit
CFO pre-WC + Interest / Interest	4.60	А	4.5	\$3,370	\$59,141
CFO pre-WC / Debt	15%	Ваа	13%	\$29,092	\$84,863
CFO pre-WC - Dividends/ Debt	10%	Ваа	9%	N.A	N.A
Debt / Capitalization	53%	Ваа	55%	\$4,435	\$60,206
Total Out Standing Debt	\$55,771		l	I	
Total green bond Capacity	\$3,370				

Source: (Moody's Investor Service, 2018)

After having the additional debt calculated for each ratio, we pick the minimum amount and let it be the additional capacity for debt of the company. In short, this is the amount of additional debt a company can take on before one of its four ratios gets downgraded. This capacity for Duke is therefore \$3.37 billion.

We perform the same calculations for two more utilities for which data are publicly available, NextEra Energy (3/2018 data) and Dominion (9/2015 data). The green bond capacities for these two utilities are \$2.1 billion and \$12.1 billion, respectively. Appendix 2 shows the details of these calculations.

Debt Capacity for the Electric Utility Sector

We apply this method to calculate an estimated lower-bound debt limit for the entire investorowned utility sector (49 utilities) using data from the Edison Electric Institute (EEI) for the year 2017. Using the sector's current financial ratios, Moody's rating limits, and our modeling approach, the total added debt capacity for the Utility sector is **\$261 billion** (Table 4). In our discussion with Moody's representatives, however, they suggested using as a simplifying assumption only the two most important ratios, CFO pre-WC / Debt and CFO pre-WC – Dividends / Debt. They also believe the real red zone for credit worthiness is at the end range of Baa – the Baa3 range – the downward limits for these ratios should be 15% and 11% respectively. With all other calculations unchanged, using just two ratios with the new limits give us a green bond capacity of **\$438 billion**. We believe these numbers provide a conservative, indicative range of the industry's potential capacity to issue added green bonds – a capacity that is clearly in the range of one third to one-half trillion dollars.

	LTM Oct	Credit		Additional	Total Debt
49 Utilities	2017	Rating	Downward Limit	Debt at limit	at limit
CFO pre-WC + Interest / Interest	5.36	А	4.5	\$307,237	\$858 <i>,</i> 836
CFO pre-WC / Debt	19.0%	Ваа	13%	\$1,097,604	\$1,649,203
CEO pro WC Dividende/ Debt	14 20/	Paa	0%	NL A	
CFO pre-wc - Dividends/ Debt	14.5%	Ddd	9%	N.A	N.A
Debt / Capitalization	55.8%	Ва	65%	\$261,167	\$812,766
Total Out Standing Debt	\$551,599			I	1
	. ,				

Table 4: 49 US utilities' debt capacity calculation (in \$million)

Source: (Edison Electric Institute , 2018)

Total green bond Capacity

6. Summary and Conclusion

Green bonds are a new and trendy financial instrument that has become increasingly popular in the recent years. By issuing green bonds, firms can take advantage of the good public image for the "green" use of proceeds, more easily meet their financing target as demand is high, and, as

\$261,167

historical data suggested, enjoy a lower default rate. The *direct* economic advantage of green bonds on original issue prices is, however, still unproven.

The worldwide utility sector is one of the top issuers of green bonds, yet in the US utilities are not very active issuers of this product. One explanation is that, although utilities carry out projects that are eligible to be financed by green bonds, they see little advantage in doing so considering the administrative efforts and costs throughout the process. A second reason might be the current low interest rate environment, where conventional debt financing is safe and easy to raise, giving a firm less motivation to change its current debt financial instrument. However, firms will eventually have to take a more careful look at their debt issuance as the Fed raises interest rates and the global market follows.

Regardless of the state of the economy or the specific pro's and con's of green bonds in the eyes of utilities, it is clear that the US utility industry has the capacity to issue at least \$250 to \$500 billion of green bonds, especially if they contribute to new revenues and cash flow.

Appendix 1: Moody's Methodology for Credit Rating

1. Regulated Framework (25%)

Why it matters

For rate-regulated utilities, which typically operate as a monopoly, the regulatory environment and how the utility adapts to that environment are the most important credit considerations. The regulatory environment is comprised of two rating factors - the Regulatory Framework and its corollary factor, the Ability to Recover Costs and Earn Returns. Broadly speaking, the Regulatory Framework is the foundation for how all the decisions that affect utilities are made (including the setting of rates), as well as the predictability and consistency of decision-making provided by that foundation. The Ability to Recover Costs and Earn Returns relates more directly to the actual decisions, including their timeliness and the rate-setting outcomes.

Utility rates are set in a political/regulatory process rather than a competitive or free-market process; thus, the Regulatory Framework is a key determinant of the success of utility. The Regulatory Framework has many components: the governing body and the utility legislation or decrees it enacts, the manner in which regulators are appointed or elected, the rules and procedures promulgated by those regulators, the judiciary that interprets the laws and rules and that arbitrates disagreements, and the manner in which the utility manages the political and regulatory process. In many cases, utilities have experienced credit stress or default primarily or at least secondarily because of a break-down or obstacle in the Regulatory Framework – for instance, laws that prohibited regulators from including investments in uncompleted power plants or plants not deemed "used and useful" in rates, or a disagreement about rate-making that could not be resolved until after the utility had defaulted on its debts.

2. Ability to recover cost and earn return (25%)

Why it matters

This rating factor examines the ability of a utility to recover its costs and earn a return over a period of time, including during differing market and economic conditions. While the Regulatory Framework looks at the transparency and predictability of the rules that govern the decisionmaking process with respect to utilities, the Ability to Recover Costs and Earn Returns evaluates the regulatory elements that directly impact the ability of the utility to generate cash flow and service its debt over time. The ability to recover prudently incurred costs on a timely basis and to attract debt and equity capital are crucial credit considerations. The inability to recover costs, for instance if fuel or purchased power costs ballooned during a rate freeze period, has been one of the greatest drivers of financial stress in this sector, as well as the cause of some utility defaults. In a sector that is typically free cash flow negative (due to large capital expenditures and dividends) and that routinely needs to refinance very large maturities of long-term debt, investor concerns about a lack of timely cost recovery or the sufficiency of rates can, in an extreme scenario, strain access to capital markets and potentially lead to insolvency of the utility (as was the case when "used and useful" requirements threatened some utilities that experienced years of delay in completing nuclear power plants in the 1980s). While our scoring for the Ability to Recover Costs and Earn Returns may primarily be influenced by our assessment of the regulatory relationship, it can also be highly impacted by the management and business decisions of the utility.

3. Diversification (10%)

Why it matters

Diversification of overall business operations helps to mitigate the risk that economic cycles, material changes in a single regulatory regime or commodity price movements will have a severe impact on cash flow and credit quality of a utility. While utilities' sales volumes have

lower exposure to economic recessions than many non-financial corporate issuers, some sales components, including industrial sales, are directly affected by economic trends that cause lower production and/or plant closures. In addition, economic activity plays a role in the rate of customer growth in the service territory and (absent energy efficiency and conservation) can often impact usage per customer. The economic strength or weakness of the service territory can affect the political and regulatory environment for rate increase requests by the utility. For utilities in areas prone to severe storms and other natural disasters, the utility's geographic diversity or concentration can be a key determinant for creditworthiness.

Diversity among regulatory regimes can mitigate the impact of a single unfavorable decision affecting one part of the utility's footprint.

For utilities with electric generation, fuel source diversity can mitigate the impact (to the utility and to its rate-payers) of changes in commodity prices, hydrology and water flow, and environmental or other regulations affecting plant operations and economics. We have observed that utilities' regulatory environments are most likely to become unfavorable during periods of rapid rate increases (which are more important than absolute rate levels) and that fuel diversity leads to more stable rates over time.

For that reason, fuel diversity can be important even if fuel and purchased power expenses are an automatic pass-through to the utility's ratepayers. Changes in environmental, safety and other regulations have caused vulnerabilities for certain technologies and fuel sources during the past five years. These vulnerabilities have varied widely in different countries and have changed over time.

4. Financial Strength (40%)

Why it matters

Electric and gas utilities are regulated, asset-based businesses characterized by large investments in long-lived property, plant and equipment. Financial strength, including the ability to service debt and provide a return to shareholders, is necessary for a utility to attract capital

at a reasonable cost in order to invest in its generation, transmission and distribution assets, so that the utility can fulfill its service obligations at a reasonable cost to rate-payers.

How We Assess It for the Grid

In comparison to companies in other non-financial corporate sectors, the financial statements of regulated electric and gas utilities have certain unique aspects that impact financial analysis, which is further complicated by disparate treatment of certain elements under US Generally Accepted Accounting Principles (GAAP) versus International Financial Reporting Standards (IFRS). Regulatory accounting may permit utilities to defer certain costs (thereby creating regulated utility may be able to defer a substantial portion of costs related to recovery from a storm based on the general regulatory framework for those expenses, even if the utility does not have a specific order to collect the expenses from ratepayers over a set period of time. A regulated utility may be able to accrue and defer a return on equity (in addition to capitalizing interest) for construction-work-in-progress for an approved project based on the assumption that it will be able to collect that deferred equity return once the asset comes into service. For this reason, we focus more on a utility's cash flow than on its reported net income.

Conversely, utilities may collect certain costs in rates well ahead of the time they must be paid (for instance, pension costs), thereby creating regulatory liabilities. Many of our metrics focus on Cash Flow from Operations Before Changes in Working Capital (CFO Pre-WC) because, unlike Funds from Operations (FFO), it captures the changes in long-term regulatory assets and liabilities.

However, under IFRS the two measures are essentially the same. In general, we view changes in working capital as less important in utility financial analysis because they are often either seasonal (for example, power demand is generally greatest in the summer) or caused by changes in fuel prices that are typically a relatively automatic pass-through to the customer. We will nonetheless examine the impact of working capital changes in analyzing a utility's liquidity (see Other Rating Considerations – Liquidity).

Given the long-term nature of utility assets and the often lumpy nature of their capital expenditures, it is important to analyze both a utility's historical financial performance as well as its prospective future performance, which may be different from backward-looking measures. Scores under this factor may be higher or lower than what might be expected from historical results, depending on our view of expected future performance. Multi-year periods are usually more representative of credit quality because utilities can experience swings in cash flows from one-time events, including such items as rate refunds, storm cost deferrals that create a regulatory asset, or securitization proceeds that reduce a regulatory asset. Nonetheless, we also look at trends in metrics for individual periods, which may influence our view of future performance and ratings.

For this scoring grid, we have identified four key ratios that we consider the most consistently useful in the analysis of regulated electric and gas utilities. However, no single financial ratio can adequately convey the relative credit strength of these highly diverse companies. Our ratings consider the overall financial strength of a company, and in individual cases other financial indicators may also play an important role.

CFO Pre-Working Capital Plus Interest/Interest or Cash Flow Interest Coverage

The cash flow interest coverage ratio is an indicator for a utility's ability to cover the cost of its borrowed capital. The numerator in the ratio calculation is the sum of CFO Pre-WC and interest expense, and the denominator is interest expense.

CFO Pre-Working Capital / Debt

This important metric is an indicator for the cash generating ability of a utility compared to its total debt. The numerator in the ratio calculation is CFO Pre-WC, and the denominator is total debt.

CFO Pre-Working Capital Minus Dividends / Debt

This ratio is an indicator for financial leverage as well as an indicator of the strength of a utility's cash flow after dividend payments are made. Dividend obligations of utilities are often

substantial, quasi- permanent outflows that can affect the ability of a utility to cover its debt obligations, and this ratio can also provide insight into the financial policies of a utility or utility holding company. The higher the level of retained cash flow relative to a utility's debt, the more cash the utility has to support its capital expenditure program. The numerator of this ratio is CFO Pre-WC minus dividends, and the denominator is total debt.

Debt/Capitalization

This ratio is a traditional measure of balance sheet leverage. The numerator is total debt and the denominator is total capitalization. All of our ratios are calculated in accordance with our standard adjustments, but we note that our definition of total capitalization includes deferred taxes in addition to total debt, preferred stock, other hybrid securities, and common equity. Since the presence or absence of deferred taxes is a function of national tax policy, comparing utilities using this ratio may be more meaningful among utilities in the same country or in countries with similar tax policies. High debt levels in comparison to capitalization can indicate higher interest obligations, can limit the ability of a utility to raise additional financing if needed, and can lead to leverage covenant violations in bank credit facilities or other financing agreements11. A high ratio may result from a regulatory framework that does not permit a robust cushion of equity in the capital structure, or from a material write-off of an asset, which may not have impacted current period cash flows but could affect future period cash flows relative to debt.

Source: (Haggarty, 2017)

Appendix 2: Green Bond Capacity Calculation for NextEra Energy and

Dominion Energy

Table 5: NextEra's debt capacity calculation (in \$million)

	LTM Mar	Credit rating for	Downward Limit	Additional Debt at	Total Debt
NextEra - Baa1	2018	ratio	at Rating	limit	at limit
CFO pre-WC + Interest / Interest	6.20	Aa	6	\$2,149	\$33,864
CFO pre-WC / Debt	24%	А	22%	\$6,331	\$38,046
CFO pre-WC - Dividends/ Debt	18%	А	17%	\$4,806	\$36,521
Debt / Capitalization	42%	A	45%	\$3,826	\$35,541
Total Debt	\$31,715				
Total green bond Capacity	\$2,149				

 Table 6: Dominion's debt capacity calculation (in \$million)

Dominion Baa2	LTM Sep 2015	Credit rating for ratio	Downward Limit at Rating	Additional Debt at limit	Total Debt at limit
CFO pre-WC + Interest / Interest	4.40	Ваа	3	N.A	N.A
CFO pre-WC / Debt	16%	Ваа	13%	\$26,489	\$54,453
CFO pre-WC - Dividends/ Debt	10%	Ваа	9%	N.A	N.A
Debt / Capitalization	56%	Ва	65%	\$12,183	\$40,147
Total Debt	\$27,964				
Total green bond Capacity	\$12,183				

Source: (Moody's Investor Service, 2018) (Moody's Investor Service, 2016)

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