Credit Ratings and Photovoltaic Investments

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Abstract

Competition is changing the financial community's view of firms in the electric supply industry; credit ratings are a key indicator of this view. We discuss the relationship between credit ratings and financial benefit and summarize the factors credit rating agencies use to assign ratings. We describe investments that two utilities have made in photovoltaics (Sacramento Municipal Utility District and Tucson Electric Power Co.) and discuss how these investments may be viewed positively from a credit rating perspective.

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Competition in the electric supply industry is increasing interest in risk management. This includes recognizing the hidden costs associated with risk,[1] effectively using financial risk management tools,[2] explicitly accounting for flexibility in the planning process,[3] and integrating risk management with strategic planning.[4]

Competition is also changing the financial community's view of firms in the industry and the way electricity suppliers are evaluated. This view is captured by the firm's stock and bond prices. Stock prices describe the value equity investors place on the firm and bond prices describe the return debt investors require to invest in the firm. While stock and bond prices are a function of a wide range of variables, credit ratings are a crucial factor in the investment decision for bond investors.

A previous work demonstrated that renewable energy technologies such as photovoltaics (PV) and wind have the potential to mitigate risk in the electric supply industry. Explicit consideration was given to the renewable energy technology's attributes of fuel costs, environmental costs, modularity, lead time, location flexibility, availability,

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[1] D. T. Brown, T. R. Lewis, and M. D. Ryngaert, *The Real Debate Over Purchased Power*, THE ELECTRICITY JOURNAL Vol. 7 No. 7, 1994, pp. 61-67; L. Kolbe and W. B. Tye, *The Cost of Capital Does Not Compensate for Stranded-Cost Risk*, PUBLIC UTILITIES FORTNIGHTLY Vol. 133 No. 10, 1995, pp. 26-28; and M. Lively, *Electric Transmission Pricing: Are Long-Term Contracts Really Futures Contracts?* PUBLIC UTILITIES FORTNIGHTLY Vol. 132 No. 19, 1994, pp. 29-32.

[2] J. C. Cater, *Valuing Options for Electric Power Resources*, THE ELECTRICITY JOURNAL Vol. 8 No. 3, 1995, pp. 43-49; and S. T. Jones and F. A. Felder, *Using Derivatives in Real Decisionmaking*, PUBLIC UTILITIES FORTNIGHTLY Vol. 132 No. 19, 1994, pp. 18-21, 25.

[3] T. W. Kaslow and R. S. Pindyck, *Valuing Flexibility in Utility Planning*, THE ELECTRICITY JOURNAL Vol. 7 No. 2, 1994, pp. 60-65.

[4] F. A. Felder, *Integrating Financial Thinking with Strategic Planning to Achieve Competitive Success*, THE ELECTRICITY JOURNAL Vol. 9 No. 4, 1996, pp. 62-67.

initial capital costs, and investment reversibility.[5] This paper builds upon that work to evaluate how PV investments may be viewed from the financial community.

I. Credit Ratings and Bond Yields

It is important to begin with an examination of the relationship between credit ratings and bond yields (i.e., bond returns). Bond yield is the discount rate that makes the bond's discounted future cash flows equal to its price.[6] Since a bond's rating is a crucial factor in the investor's decision of how much to pay for the bond,[7] rating agencies indirectly affect bond yields by the ratings they assign.

Table 1 summarizes the long-term credit rating symbols and their meanings for ratings issued by Moody's[8] and Standard and Poor's.[9] The ratings are broadly grouped within the categories of investment grade and speculative grade bonds; in addition, most ratings can be modified by 1, 2, or 3 (Moody's) or + or - (Standard and Poor's). The difference between speculative and investment grade ratings is important because this limits who can invest in the bonds.[10]

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[5] T. E. Hoff and Christy Herig. *Managing Risk Using Renewable Energy Technologies*, SYMPOSIUM ON THE VIRTUAL UTILITY, TOPICS IN REGULATORY ECONOMICS AND POLICY SERIES, Kluwer Academic Publishers: Boston, MA., 1997. T. E. Hoff, INTEGRATING RENEWABLE ENERGY TECHNOLOGIES IN THE ELECTRIC SUPPLY INDUSTRY: A RISK MANAGEMENT APPROACH, National Renewable Energy Laboratory Report NREL/SR-520-23089, 1997.

[6] R. A Brealey, and S. C. Myers, PRINCIPLES OF CORPORATE FINANCE, fourth edition, New York: McGraw-Hill, 1991, p. 48.

[7] R. Cantor and F. Packer, *The Credit Rating Industry*, FEDERAL RESERVE BANK OF NEW YORK QUARTERLY REVIEW Vol. 19 No. 2, Summer-Fall 1994, pp. 1-26.

[8] See MOODY'S BOND RECORD for exact rating definitions

[9] See STANDARD AND POOR'S CORPORATE RATINGS CRITERIA for exact rating definitions (http://www.ratings.standardpoor.com/criteria.htm).

[10] Commercial banks and many pension funds and other financial institutions are not allowed to invest in bonds unless they are investment grade. *Supra* note 6, p. 579.

Table 1. Long-term credit rating symbols and their meanings.

	Moody's	S&P	Interpretation
Investment Grade	Aaa	AAA	Highest quality
	Aa	AA	High Quality
	A	A	Strong payment capacity
	Baa	BBB	Adequate payment capacity
Speculative Grade	Ba	BB	Adverse conditions could lead to payment difficulties
	B	B	Adverse conditions will likely lead to payment difficulties
	Caa	CCC	Moody's: sometimes default; S&P: vulnerable to default
	Ca	CC	Moody's: often default; S&P: highly vulnerable to default
	C	C	Moody's: lowest rated; S&P: bankruptcy filed w/o default
		D	Payment is in default

The left side of Figure 1 presents the historical relationship between average bond yield in the 4th quarter of 1995 and bond rating (ignore the right side of the figure for the moment).[11] There are two things to notice about the figure. First, bond yield increases as bond rating decreases. This is as expected because investors require a higher rate of return to compensate for higher levels of risk associated with lower quality bonds. Second, and somewhat surprising, there is a large difference in bond yields for the speculative grade bonds while there is little difference in bond yields for investment grade

[11] The average bond yields for the investment grade bonds (Aaa through Baa) represent averages calculated by Moody based on all of their bonds and reported in MOODY'S BOND RECORD. Unfortunately, bond rating agencies such as Moody's and Standard and Poor's as well as other financial information sources only publish averages for investment grade bonds. In order to complete the rest of the curve (i.e., the ratings for bonds rated Ba, B, and Caa), data on individual bond issues with ratings below Baa that were issued during the 4th quarter of 1995 were collected from MOODY'S BOND RECORD and averaged. There were 5 companies, 15 companies, and 4 companies with the ratings of Ba, B, and Caa in the average; most of the bonds had a 10 year life.

bonds. For example, the average yield for the Aaa, Baa, and Caa rated bonds is 7.0, 7.6, and 13.2 percent so that the difference in yields between bonds rated Aaa and Baa is 0.6 percent but the difference in yields between bonds rated Baa and Caa is 5.6 percent. This suggests that bonds with speculative grade ratings stand to gain the most from rating improvements.[12]

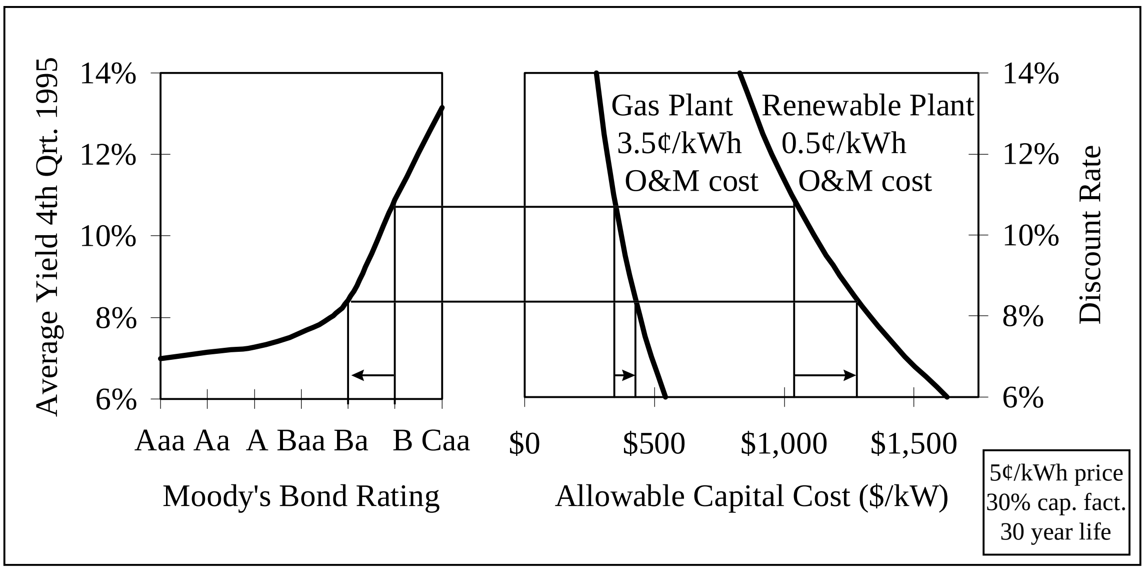

Figure 1. Bond ratings, bond yields, and allowable capital cost.

II. Credit Ratings and Financial Benefits

Improved credit ratings can benefit a firm financially in several ways. Improved credit ratings for a specific project could increase the project's viability. Better credit ratings translate to lower bond yields and lower bond yields mean a lower cost of money so that

[12] The distribution of bond ratings for firms in the electric power industry with corporate ratings in STANDARD AND POOR'S BOND GUIDE, May 1996 was 1 percent (AAA), 16 percent (AA), 44 percent (A), 25 percent (BBB), 11 percent (BB), and 3 percent (B).

less money is required to obtain the same amount of capital investment. An example of this type will be given in Section III.

In addition, bond ratings within a given firm tend to be similar and change at the same time.[13] Thus, it may also be possible that a series of strategic investments can improve all of a firm's bond ratings. The financial benefit of this is a lower cost of money for future bond issues.

III. Credit Ratings and PV

As illustrated in the previous sections, credit ratings are important for any investment. PV investments may be even more sensitive to their credit ratings, however, due to their capital-intensive nature. Consider the following example.

The right side of Figure 1 presents the relationship between a project's discount rate and its allowable capital cost[14] for two hypothetical plants: a PV plant and a natural gas plant. The plants are identical[15] except that the gas plant has high variable costs (3.5¢/kWh) and the PV plant has low variable costs (0.5¢/kWh). Suppose that the bond yield is the same as the discount rate so that the left and right sides of Figure 1 can be combined.[16] The firm's credit rating matters the most for the PV plant due to its capital-

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[13] This can be seen by examining a book of credit ratings, *supra* note 12.

[14] The allowable capital cost C_0 is defined to be the initial capital cost that makes the discounted revenue minus variable cost equal to the initial capital cost. The annual revenue equals the price of electricity P_t (\$/kWh) times the quantity sold Q_t (kWh). Assuming constant returns to scale, the annual variable cost equals the marginal variable cost V_t (\$/kWh) times the quantity sold Q_t (kWh). Thus, the allowable cost equals $C_0 = \Sigma_{t=1}^{T} (P_t Q_t - V_t Q_t)(1+i)^{-t}$, where the discount rate i is based on the cost of capital. Solving for the allowable capital cost when price, variable cost, and quantity are constant over time results in $C_0 = (P-V)Q[1-(1+i)^{-T}]/i$.

[15] Fixed 5¢/kWh electricity sales price, 30 percent capacity factor, and 30 year life.

[16] While this is not strictly true in practice (because projects are typically financed using a mixture of debt and equity, bond life may vary from project life, etc.), it is representative of reality and the

intensive nature. Depending upon whether the rating is B or Ba, Figure 1 shows that there is an $80/kW difference in allowable capital cost for the gas plant while there is a $250/kW difference in allowable capital cost for the PV plant. That is, the absolute difference in allowable capital cost is more sensitive to the bond rating for the PV plant than for the gas plant.

IV. Factors Affecting Credit Ratings

The previous sections have established that there is an important relationship between credit ratings and bond yields, that there are several ways improved credit ratings can benefit a firm, and that credit ratings are particularly important for PV due to its capital intensity. This section discusses the factors affecting credit ratings.

The key consideration rating agencies give in assigning long-term ratings is the likelihood that payment will be met. While there is no fixed formula by which ratings are calculated, the rating is based on a combination of the rating agencies' assessment of the firm's business and financial risk.

Financial risk is assessed by examining historical results as well as future projections. The assessment can include factors such as earnings protection, capital structure, cash flow adequacy, and financial flexibility. Business position is the qualitative measure of a firm's fundamental creditworthiness. It focuses on the forces that will shape the firm's future.

Rating agencies are increasing their focus on factors affecting business risk due to competition. For example, growing competition has caused Standard and Poor's to shift

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assumption provides the reader with an indication of what can happen to a project's viability as the bond its emphasis for municipal utility ratings from service area economics and financial performance to business position. In addition, competition has caused a new type of single asset power generation to evolve that Standard and Poor's calls the "merchant power plant." Table 2 presents the factors affecting business risk that Standard and Poor's considers in rating securities for IOUs, municipal utilities, and independent power projects.

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rating changes.

Table 2. Factors credit rating agencies assess when evaluating business risk for IOUs, municipal utilities, IPPs.[17]

Factor	Brief Description
IOUs	
Markets and service area economy	Long-term electricity demand from macroeconomic perspective
Competitive position	Ability to retain customers when competing against suppliers
Operations	Cost, reliability, and quality of service
Regulation	Consideration given to competition when setting policies
Management	Ability to respond in a competitive environment
Fuel and power supply	Reserve margins, fuel mix, fuel and power contracts, and DSM
Asset concentration	Level of dependence on any particular investment
MUNICIPALS	
Management	Ability to respond in a competitive environment and work with local councils or boards of directors
Operations	Power supply, capital needs, and operating efficiency
Competitive position	Rates and comparison to cost of potential alternatives
Markets	Customer base and demographic characteristics
POWER PROJECTS	
Output sales contracts	Structure of output sales contract with power purchaser
Power costs	Costs relative to alternatives under various market conditions
Fuel risk	Fuel arrangements to protect cash flow against fuel market conditions
Technology risk	Construction risk (built on schedule and as budgeted) and operating risk (cost and reliability)

V. Two Utilities that are Investing in Photovoltaics

As stated above, credit rating agencies are placing a greater emphasis on the business risk that firms face in assigning credit ratings. PV investments have the potential to be beneficial to utilities. This section presents two examples of utilities that are investing in

[17] *Supra* note 9, 1996 and STANDARD AND POOR'S MUNICIPAL FINANCE CRITERIA, 1996. Standard and Poor's has developed a new set of rating criteria for merchant power plants in STANDARD AND POOR'S GLOBAL PROJECT FINANCE, September 1996. The merchant power plant differs from the independent

PV and then discusses how the investments might be beneficial. First, Sacramento Municipal Utility District (SMUD) has been investing in PV generating capacity. Second, Tucson Electric Power Co. has invested in PV manufacturing capability.

A. Sacramento Municipal Utility District

SMUD is a municipal utility that has strong ratings[18] and has been aggressively investing in PV generating capacity.[19] SMUD is in a good position to invest in PV generation because of its good credit rating, its tax exempt status, and thus its low discount rate. Its investment includes the popular PV Pioneers Program[20] as well as other distributed PV generation applications. While the threat of competition from other utilities has convinced SMUD to scale back its commitments to most renewable resources, SMUD's investment in PV continues. In fact, SMUD board elected on May 1, 1997 to spend $26 million to add 10 MW of PV power to SMUD's system. This investment is the largest single purchase of photovoltaics of any utility in the country in spite of increasing pressure to reduce costs as California's electricity market is opened to competition.[21]

B. Tucson Electric Power Co.

Tucson Electric Power Co. is another utility that is viewing an investment in photovoltaics as a strategic future investment. This is in spite of the fact that the utility is

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power producer in that it generally will not have a purchase power agreement and thus faces the additional risk of uncertain output prices.

[18] It has received an Aaa rating by Moody on most of its bonds for more than 10 years.

[19] SMUD's investment in renewables and energy efficiency began after it closed its nuclear plant at Rancho Seco in 1988. E. Smeloff and P. Asmus, REINVENTING ELECTRIC UTILITIES: COMPETITION, CITIZEN ACTION, AND CLEAN POWER. Island Press: Washington, D. C. 1997.

[20] PV Pioneers customers pay a premium for their power and have PV systems installed on their roofs.

emerging out of a near-bankruptcy situation 6 years ago.[22] Tucson Electric has established four wholly-owned subsidiaries for the purpose of pursuing various energy-related investment opportunities. One subsidiary is Advanced Energy Technologies, Inc. This subsidiary holds a 50 percent ownership interest in Global Solar Energy, LLC (the other owner is ITN Energy Systems), a venture that will develop and manufacture thin-film photovoltaic cells at a 1.5 MW manufacturing facility. While the investment is small compared to its regulatory investments, Tucson Electric views the investment as a future growth option.[23]

VI. What's the Rationale for an Investment In PV?

What is the rationale for these two utilities' investments in PV and how can they improve the utilities' business position? This section provides some possible answers. The first three subsections address the issue from the perspective of owning the PV generating capacity. The final subsection (Competitive Position) includes the perspective of owning manufacturing capability.

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[21] *SMUD to Buy 10 MW of Photovoltiacs, Winning Some Economic Development*, ELECTRIC UTILITY WEEK, May 12, 1997.

[22] Moody's rated Tucson Electric Power Company's secured debt at Ba3 in 1990 and then reduced the rating to B3 and then to a low of Caa in August 1991 when its creditors tried to force it into bankruptcy. The rating rose to B3 (1992), to B1 (1993), and finally to Ba3 (1995) where it is currently at today (*Moody's Bond Record,* various years). In July 1997, Standard and Poor's upgraded TEP's secured debt rating to BB- from B+ where it had been since the Company's financial restructuring in 1992.

[23] "In comparison to the Company's large investment in regulated utility assets, the Company's current investments in [the four subsidiaries] Nations Energy, Advanced Energy, SWPP, and Southwest Energy are not material in terms of recorded assets or net income. As of December 31, 1996, the Company's Consolidated Balance Sheet reflected an investment in energy-related ventures of approximately $22 million [in all four subsidiaries]… However, depending upon the nature of future investment opportunities, and the ability of the Company to make additional investments as determined by the [Arizona Corporation Commission] and in certain credit agreements, the Company expects to make additional investments in these subsidiaries and in other energy-related ventures. Over time, such additional investments may have a material impact on the Company's future cash flow and profitability." (1996 10-K SECURITIES FILING, page 23).

A. Low Fuel And Environmental Costs

Fuel price risk is a business risk factor common to IOUs, municipal utilities, and power projects. "Dependence on any single fuel means exposure to that fuel's problems: electric utilities that rely on oil or gas face the potential for shortages and rapid price increase; utilities that own nuclear generating facilities face escalating costs for decommissioning; and coal-fired capacity entails environmental problems stemming from concerns over acid rain and the greenhouse effect."[24] By contrast, PV has no fuel or potential environmental costs. Thus, it avoids the problems associated with rapidly increasing fuel prices or potential environmental costs that may be incurred in the future due to a change in regulation. The lack of fuel price risk could be particularly attractive within a generation portfolio.[25]

B. Modularity

PV is a modular technology that is beneficial in a number of ways. First, as shown in Table 2, construction risk is an important factor for power projects. Standard and Poor's estimates that many fixed-price, turnkey contracts charge upward of a 30 percent premium; they recognize that creative ways are needed to minimize construction costs.[26] Modular PV plants provide project developers with off-ramps so that stopping a project is not a total loss because a plant can be used to generate revenue even if it is only partly

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24 *Supra* 9, 1996, p. 33.

25 This is part of the basis for the Renewables Portfolio Standard, N. A. Rader, and R. B. Norgaard, *Efficiency and Sustainability in Restructured Electricity Markets: The Renewables Portfolio Standard*, ELECTRICITY JOURNAL Vol. 9 No. 6, 1996, p. 37-49.

26 STANDARD AND POOR'S GLOBAL PROJECT FINANCE, September 1996, p. 9.

completed. This mitigates some of the construction risk associated with non-modular plants.

Second, operations, and thus plant reliability, is a factor that is of concern to any type of plant operator. While PV plants are dependent on the weather, a number of studies have shown that there can be a good match between output and demand for power.[27] In addition, modular plants have less variance in their equipment availability than non-modular plants if the outages are not correlated. This is because it is very unlikely that the entire plant will become inoperable by all modular components failing simultaneously while the same is not true for non-modular plants.

Third, an important interaction occurs between demand uncertainty and short lead-time plants, a characteristic typically associated with modular plants. Plants with short lead-times provide decision-makers with the option to wait to install any project until after more demand uncertainty is resolved and it is known whether or not the plant will be needed. This attribute becomes particularly important in a distributed generation setting where the tradeoff is between a small amount of strategically located generation or a large new transmission facility.[28]

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[27] R. Perez, R. Seals, and R. Stewart, *Assessing the Load Matching Capability of Photovoltaics for US Utilities Based Upon Satellite-Derived Insolation Data*, CONFERENCE RECORD OF THE IEEE PHOTOVOLTAIC SPECIALISTS CONFERENCE, 1993, pp. 1146-1151; and T. Hoff, *Calculating Photovoltaics' Value: A Utility Perspective*, IEEE TRANSACTIONS ON ENERGY CONVERSION Vol. 3 No. 3, 1988, pp. 491-495.

[28] T. E. Hoff, *Using Distributed Resources to Manage Risks Caused by Demand Uncertainty*, forthcoming in a special issue of THE ENERGY JOURNAL, Fall, 1997.

C. Location Flexibility

Uncertain costs of any kind increase a firm's business risk. The cost of transporting power will become increasingly uncertain as transmission and distribution facilities are opened up to all competitors. This cost uncertainty, however, will not be an issue for PV when used in a distributed generation setting because it produces power where it is consumed and thus avoids transportation costs.[29] This is particularly true with congestion based pricing because the only time that PV is likely to need to transport power out of the area (and thus incur transportation costs) is when demand, and thus transportation costs, are low.

D. Competitive Position

PV investments have the potential to improve a utility's competitive position by enabling it to offer new products and services. There are several ways that this could occur. First, some customers want a portion of their electricity to come from renewables.[30] Utilities that offer products that customers desire will retain these customers when there are other alternatives. While there are not many of these types programs and experience to date indicates that they are limited to less than 3 percent of

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[29] H. J. Wenger, T. E. Hoff, and J. Pepper, PHOTOVOLTAIC ECONOMICS AND MARKETS: THE SACRAMENTO MUNICIPAL UTILITY DISTRICT AS A CASE STUDY, SPONSORED BY SACRAMENTO MUNICIPAL UTILITY DISTRICT, California Energy Commission, and North Carolina Solar Center (September 1996). T. E. Hoff, H. J. Wenger, and B. K. Farmer, *Distributed Generation: An Alternative to Electric Utility Investments in System Capacity*, ENERGY POLICY Vol. 24 No. 2, 1996, pp. 137-147.

[30] B. Byrnes, et. al., *Green Pricing : The Bigger Picture*, PUBLIC UTILITIES FORTNIGHTLY Vol. 134 No. 15, 1996, pp. 18-21 discusses how seven utilities have launched green pricing programs; some utilities sell renewable electricity to residential customers as a product. SMUD's PV Pioneers Program has been particularly well received.

residential electric customer participation in any utility,[31] surveys have shown that a much larger percentage of the public is willing to participate.[32]

Second, a utility can target its programs to customers in other utilities' service territories. SMUD, e.g., will launch a green marketing campaign in mid-1997 targeted at existing customers as well as those currently served by Pacific Gas & Electric, the investor-owned utility whose service territory surrounds SMUD. The utility plans to aggressively promote its green marketing outside of its service territory as a direct-access provider in order to take advantage of state-funded rebates to customers of investor-owned utilities.

Third, the utility can offer other products. Tucson Electric is positioning itself to enter the PV manufacturing business in a technology that has the potential to be low cost. SMUD is positioning itself to provide technical consulting services on PV for other utilities and to aggregate purchases with other utilities to further cut its costs.[33]

VII. Conclusions

Competition is changing the financial community's view of firms in the electric supply industry; credit ratings are a key indicator of this view. This paper discussed the relationship between credit ratings and financial benefit and presented the factors credit

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[31] *Supra* note 30.

[32] K. J. Smith, CUSTOMER DRIVEN MARKETS FOR RENEWABLE GENERATED ELECTRICITY, A Report from the California Regulatory Research Project, The Center for Energy Efficiency & Renewable Technologies, 1996, p. 15 states that almost half of utility customers in California would be willing to pay up to 4 percent more to purchase electricity generated by renewables. SMUD surveys show that as many as 36,000 of its 480,000 customers would be willing to pay price premiums for PV panels to be installed on their roofs. *Supra* note 21.

[33] SMUD has already received letters of interest from the following municipal utilities for PV purchases: Anaheim, Roseville, Palo Alto, Needles, Trinity County, and the Turlock Irrigation District. *Supra* note 21.

rating agencies use to assign ratings. It presented two utilities that have made investments in PV (Sacramento Municipal Utilities District and Tucson Electric Power Co.) and discussed how these investments may be viewed positively from a credit rating perspective. The general conclusion of the paper is that PV investments have the potential to be viewed positively from a ratings perspective. Other utilities might consider similar investments.

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