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Net Metering and Interconnection Standards for Santee Cooper and Three Investor-Owned Utility Companies in South Carolina

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Introduction

Purpose of Net Metering and Interconnection Standards

Net metering and interconnection standards are designed to allow private residential and non-residential electric utility customers to pursue generating some of their own electricity through renewable sources such as solar, wind, and geothermal power. Net metering allows customers to use their own electrical generation to offset their consumption over a billing period by allowing their electric meters to run backwards when they generate electricity in excess of their demand (SC Energy Office, vi). The interconnection standards govern the technical and procedural process by which an electric customer connects an electric-generating system to the electrical grid of their utility company (SC Energy Office, v).

There are many factors that come into play with how successful a customer owned renewable energy generator such as a photovoltaic system is in regards to cost efficiency and savings. Some of these factors include the respective cost of electricity at certain times during the day and in what part of the year, such as in winter or summer, when charged rates for electricity consumption vary. All of these can play a factor in how successful a customer is with their cost savings from their own renewable energy generator. In addition to net metering and interconnection standards, tax credits are issued to eligible customers wishing to implement renewable energy into their homes or businesses. Currently, South Carolina's renewable energy tax credit allows taxpayers to receive 25% of the cost to purchase and installation of solar equipment, up to $3,500 per year over ten years to a maximum of $35,000 (SC Energy Office, 1). The laws that led to

net metering and interconnection standards in states nationwide begin with the Public Utility Regulatory Policies Act (PURPA) of 1978 and its most recent amendment in the EPAct of 2005.

PURPA and EPAct of 2005

The Public Utility Regulatory Policies Act (PURPA) was enacted in 1978 and encouraged the following: 1) the conservation of energy supplied by electric utilities; 2) optimal efficiency of electric utility facilities and resources; and 3) equitable rates for electric consumers (SC Energy Office, 2). PURPA was passed by the U.S. Congress in 1978 as part of the National Energy Act under President Jimmy Carter. For the first time, this law allowed non-utility electric power producers to sell power to electric utility companies at the avoided cost rate. The avoided cost rate is basically the traditional rate that it costs electric utility companies to create their own power (Bodell, 18).

PURPA was amended most recently by the Energy Policy Act of 2005 (EPAct) which included a section requiring states and utilities to consider implementing five new federal standards, including net metering and interconnection. Net metering standards in South Carolina are compared and evaluated along with the Southeastern Association of Regulatory Utility Commissioners (SEARUC), a group of ten states in the southeast. As of 2009, seven of those states have established their own net metering and/or interconnection standards through either legislation or by their respective Public Service Commission (PSC) (SC Energy Office, 3). [1] Since External Disconnect Switches are mandatory for renewable energy generators in South Carolina, it is important to discuss them in some detail.

External Disconnect Switches: A Requirement in South Carolina

South Carolina requires External Disconnect Switches (EDS's) for all renewable energy generators connected to a utility grid. This could potentially increase the cost for utility consumers of their renewable energy generators and discourage other consumers from choosing to buy renewable energy generators (NREL 2008).

An external disconnect switch (EDS) is a hardware feature that allows a utility's employees to manually disconnect a customer-owned photovoltaic generator from the electricity grid (NREL 2008). Proponents of the EDS claim that it is necessary to keep utility company workers safe when making repairs to the electric distribution system while opponents assert that it is unnecessary and adds costs without providing substantial benefits (NREL 2008). External disconnect switches have become a bigger issue as the market for Photovoltaic systems has grown in the United States from almost none before 2000 to just over 30,000 in 2006 (NREL 2008, 1). The main idea behind EDSs is that a renewable energy generator connected to the electric grid needs to be turned off in event of something such as a power outage or when there is construction on electric lines in the area. While EDSs could make workers safer, they could also raise operational costs and increase electricity rates for consumers because of the extra work required by a utility worker to manually turn off one.

In comparison to EDSs, many consumers of renewable energy use modern electronic inverters (EI). In 2005, Underwriters Laboratory (UL) passed the standard UL 1741 that applies to EIs. An EI is the device that converts the DC electricity output from solar PV cells into AC that is used in homes and businesses (NREC 2008, 6). The

advantage of an EI is that it does not have to be turned off manually by a utility worker but, rather is, turned off automatically upon loss of utility voltage and will remain in that position until utility voltage has been restored automatically (NREC 2008, 6). Under all abnormal or grid-outage conditions, an EI will disconnect in two seconds or less and only reconnect after five minutes of normal utility conditions.

Scope of Thesis

The purpose of net metering and interconnection standards included in the introduction shows why they are important for renewable energy users, followed by some laws that paved the way for these policies nationwide. The best practices for net metering and interconnection standards will be discussed followed by the current net metering and interconnection standards in South Carolina for three investor-owned utility companies and Santee Cooper. A summary of the state's ranking compared to other states on the effectiveness of their net metering and interconnection standards are important in evaluating these policies. In addition, recommendations for our state's future policies will be discussed.

The methods section will cover the current net metering policies as they apply specifically to the three investor owned utilities (Duke Power, Progress Energy, South Carolina Energy and Gas) and the state-owned energy company Santee Cooper. This information will include the electric rates they charge as well as other data. The subject of this thesis project involves the analysis of how Santee Cooper compares to the three investor owned utilities in regards to its net metering policies and the number of current net metering customers.

Literature Review

Some Preliminary Findings

An analysis of the Network for New Energy Choices's (NNEC's) report by the National Renewable Energy Laboratory (NREL) has established that there appears to be "no significant relationship between policy and development for the states that currently have a net metering and/or interconnection policy" (NREL 2009, 116). For the NNEC's mission statement, see appendix a. Additionally, the states that have a high policy grade do not have a significant effect on increasing renewable energy generation. While the findings of the analysis of the NNEC document by the NREL do not support a direct connection between a policy and increased generation in the same year, "it is hypothesized that states that followed best practice guidelines for net metering and interconnection policies in 2005 would perform stronger in renewable energy development indicators in the following years" (NREL 2009, 116).

Net metering and interconnection standards are still important in that they provide the basic technical and legal framework for connecting a renewable energy generator to the electric grid.

Net Metering Best Practices Nationwide

Net metering can be financially beneficial to both the consumer and utility company if the proper policies are used within a particular state. However, if the policy mix is poor, this could reduce financial savings for consumers and result in possible revenue losses for the utility company. The NREL 2009 analysis of an NNEC 2008 report provides a comprehensive review on seven best practices for net metering in all

states that can have a positive impact on renewable energy development (see appendix c). These seven best practices for net metering include: *individual system capacity, program capacity limits, rollover restrictions, metering issues, renewable energy credit (REC) ownership, eligible technology, and eligible customers* (all italics are the author's emphasis).

The *individual system capacity* practice states that uniform limits in generator size can reduce regulatory confusion, and increasing the eligible facility size for nonresidential systems could encourage participation in net-metering by large investors. The *program capacity limits* can restrict the expansion of on-site renewable generation, and the best practice is to not limit the total aggregate capacity eligible for net metering. The *rollover restrictions* refer to when a customer has generated more electricity during a given month and this excess electricity is not allowed to be carried over. The NNEC argues that there should be no rollover restrictions and this excess electricity should be carried over to their next month's utility bill. The *metering issues* best practice allows customer-sited generators to use their existing meters when possible. However, if this is not the case, time-of-use (TOU) meters with time bin carryovers can reward generators that produce during peak demand periods more when electricity is at its highest price. As for the *renewable energy credit (REC) ownership*, owners of RECs should be allowed to maintain ownership of their RECs. The last two best practices, *eligible technology* and *eligible customers*, specify that any renewable or zero-emissions technologies should be allowed as well as any customers.

In summation, these net metering best practices aim to not limit a residential or business customer's ability to generate renewable energy. The more flexible the net

metering policies, the more advantageous it is for the customer so that they do not get discouraged because of technical and legal requirements.

Interconnection Standards Best Practices Nationwide

As mentioned previously, interconnection standards and net metering policies can help encourage renewable energy generation by residential and non-residential consumers. Although many states have policies, they are not all the same and provide customers with the highest potential to maximize cost savings. The organization Network for New Energy Choices (NNEC) released a report in 2008 titled "Freeing the Grid: Best and Worst Practices in State Net-Metering Policies and Interconnection standards 2008" (NREL #2, 57). This report, which has been analyzed by the NREL, included 14 of the Best Practices for Interconnection Standards Nationwide. To see all 14 Best Practices Nationwide, see appendix b. For sake of time, I will only analyze four of the more important best practices: *eligible technology, individual system capacity, "breakpoints" for interconnection process,* and *timelines*.

The best practice for *eligible technology* claims that while interconnection typically focuses on renewable energy, another generator using a different energy resource should also be allowed if it fully meets the standard requirements and there are no operational hazards involved. The *individual system capacity* refers to how rules should apply to various sized renewable energy generators. If a system is small, the interconnection standards should be less rigid and as a generator becomes larger and more complex, the rules should be more specific. The *"breakpoints" for interconnection process"* maintain that the interconnection process should be broken into four

breakpoints for larger generator systems at intervals of 10 kW, 2 MW, 10 MW (non-exporting systems), and 20 MW to allow for thorough studies of the larger alternative generator systems.

And lastly, *timelines* refer to the step-by-step process of connecting a generator into the electric grid. The Federal Energy Regulatory Commission (FERC) has standards that establish a timeline for each step of the application process according to the type of generator used. Reducing the amount of time that each step of the process takes can produce a quicker and easier installation process (NREC 2009, 57). The net metering and interconnection standards in South Carolina are young and not standardized for all utility companies, as the next section will reveal.

Net Metering and Interconnection Standards in South Carolina

In South Carolina, there are four investor-owned utilities: Duke Energy Carolinas, Progress Energy Carolinas, South Carolina Electric & Gas Company (SCE&G) and Lockhart Power. These investor-owned utilities (IOUs) are governed by a board of directors operating at the direction of investors and regulated by the state's Public Service Commission (PSC) (SC Energy Office, 12). Santee Cooper, also known as the South Carolina Public Service Authority, is similar to the IOUs in that it serves a large area and generates its own power, but differs in that it is a state entity governed by a board appointed by the Governor. The net metering and interconnection policies for three of the IOUs (Duke Energy Carolinas, Progress energy Carolinas and SCE&G) are similar, but not identical, to those of Santee Cooper.

For the three participating IOU's, there is a limit on the system size of a renewable energy generator of 20 kW for residential customers and 100 kW for non-residential customers for both their net metering policy and interconnection standards. As with the interconnection standards of Santee Cooper, there is an insurance requirement policy with homeowners of $100,000 and non-residential of $300,000 (SC Energy Office, 17). For a complete description of these policies, see appendix A. Additionally, both these three IOUs and Santee Cooper respectively require external disconnect switches.

Summary of The Effectiveness of South Carolina's Net Metering and Interconnection Standards

Now that these best practices for net-metering and interconnection standards have been discussed, the state of South Carolina will be compared to the rest of the United States. The NNEC has given each state a score ranging from an A-F (A being the best, F being the worst) for all 50 states in its 2009 report. In 2009, South Carolina received a n/a score for its net metering policy and an F for its interconnection standards (NNEC, 77). The n/a score for net metering means that there was no statewide policy in 2009 applying to all utility companies. The F score for interconnection standards means that there were many barriers to interconnection, and most of the distributed generation (DG) systems will be blocked from interconnecting because of the standards (NNEC, 38). In respect to the rest of the United States, South Carolina has one of the worst rankings in both net metering and interconnection standards.

While a complete description of the NNEC's report on South Carolina is unnecessary for the purpose of this report, it is necessary to mention a few things. First of all, the interconnection standards enforced in South Carolina currently apply only to the Investor-owned utilities previously discussed. Secondly, the eligible technologies for interconnection are: solar thermal, electric, photovoltaics, landfill gas, wind, biomass, fuel cells, municipal solid waste, CHP/cogeneration, anaerobic digestion, small hydroelectric, micro turbines, as well as other distributed generation technologies (NNEC 2009, 77).

Recommendations for South Carolina's Net Metering Policies the South Carolina Energy Office and Office of Regulatory Staff

Now that South Carolina's net metering and interconnection scores have been discussed, it is appropriate to offer some recommendations from the NNEC, the Office of Regulatory Staff, and the South Carolina Energy Office. The latter two offer recommendations only for the investor-owned utilities and Santee Cooper. First, the recommendations for net metering and interconnection standards from the Office of Regulatory Staff and the South Carolina Energy Office will be covered followed by those of the NNEC.

There are seven recommendations for net metering by the Office of Regulatory Staff and the South Carolina Energy Office, of which five will be discussed. The reason only five will be discussed is because these five appear to be the most important. The *first recommendation* is to standardize the net metering program structure across utilities. Standardizing the net metering program structure across utilities will simplify the process

by providing consistency across utilities. This could help encourage the future development of renewable energy in South Carolina by offering a single set of "rules" for all stakeholders. The *fourth recommendation* is to eliminate stand-by charges for residential customers. Each utility has an obligation to provide electricity to its customers, and stand-by charges are intended to recover utility costs for maintaining additional facilities that provide electrical service to customers with large on-site self generation in the event their on-site self generation is forced off-line. Basically, customers may be required to pay stand-by charges in the event that the utility company cannot provide power from its main source. This however should not be a problem for small renewable energy systems since they provide only a small portion of electricity for utility companies.

The *fifth recommendation* is to allow renewable energy generator owners to retain ownership of their Renewable Energy Credits (RECs). Since 2007, there has been a slowly developing market and interest for RECs by renewable generating customers. Renewable energy generating customers should be allowed to retain ownership of their RECs to offset their electricity usage. The *sixth recommendation* is to require annual reporting to the SC Office of Regulatory Staff and SC Energy Office of the number of net metering customers by renewable energy generator type to allow for continuing assessment of net metering programs.

Each utility company should provide an annual report which summarizes their net metering activity to the South Carolina Energy Office and the Office of Regulatory Staff. This annual report should coincide with the annual demand-side management reports to the State Energy Office, as is currently required by state law. And lastly, the

seventh recommendation is to formally revisit the net metering process within 4 years. After obtaining 4 years of data on the subject, the state should formally assess the effectiveness of net metering policies to ensure they appropriately reflect their energy goals (SC Energy Office 2008, ii-iii).

Recommendations for South Carolina's Interconnection Standards from the South Carolina Energy Office and Office of Regulatory Staff

There are 4 recommendations for interconnection standards. The *first recommendation* is to standardize interconnection standards across utilities. Establishing statewide and standardized interconnection standards will help simplify connecting renewable generators to the grid by providing consistency across utilities. This approach would encourage the development of renewable resources in South Carolina by offering a single set of rules for all stakeholders. The *second recommendation* is to adopt Federal Energy Regulatory Commission (FERC) 3-Tier Interconnection Standards as revised by the North Carolina Utilities Commission. Two of the major IOUs in SC have implemented the North Carolina Revised Standards on Interconnection. Adopting the FERC 3-Tier Interconnection Standards as revised by NC Utilities Commission would foster consistency with NC utilities as well as establish FERC's successful Interconnection Standards. Additionally, the SC Interconnection Standards should give utilities the option of including an external disconnect switch (EDS) as a mandatory policy.

The *third recommendation* is to require annual reporting to SC Office of Regulatory Staff and SC Energy Office of the number of requests and successful

interconnections by renewable energy generator type to allow for a continuing assessment of SC Interconnection Standards. As with the net metering policies, each utility should provide an annual report summarizing its interconnection activity to the SC Energy Office of regulatory Staff and the SC Energy Office. Finally, the *fourth recommendation* is to formally revisit the SC Interconnection Standards within 4 years. The state should formally assess the effectiveness of interconnection standards after 4 years to ensure they meet the state's energy goals (SC Energy Office, iii).

Recommendations for Net Metering and Interconnection Standards from the NNEC

Now that the recommendations from the SC Office of Regulatory Staff and SC Energy Office have been discussed, it is time to discuss those from the NNEC. The NNEC's recommendations for improving South Carolina's net metering policies are that the state should adopt the Interstate Renewable Energy Council's (IREC) model net metering rules (NNEC, 77). The NNEC's recommendation for the interconnection standards in South Carolina is that the state should adopt IREC's model interconnection standards (NNEC, 77). The IREC first developed its model rules for net metering and interconnection standards in 2003. [2]

Methods

The information found about these energy companies' net metering and interconnection standards was largely found on the internet. The South Carolina Energy Office and Office of Regulatory Staff were of assistance by telephone in advising how to find this information. Phone calls were on the dates of April 5th, 6th, 7th, as well as other dates to the Office of Regulatory Staff. The South Carolina Energy Office advised me to

speak with the Office of Regulatory Staff, which told me about the public service commission's website that had useful information regarding the 3 IOU companies in South Carolina on which this thesis is focused (Office of Regulatory Staff, Telephone Interview). Net metering information for Santee Cooper was found by contacting Phillip Greenway at Santee Cooper, who provided me with an email that contained useful information (Greenway, Net Billing).

The Public Service Commission's website 3 has dockets that were filed regarding the number of net metering customers for Duke Power, Progress Energy, and the South Carolina Energy and Gas Company. This thesis is to focus on the net metering rates and energy savings, which could be found for Duke Power and Progress Energy in the 2008 report about net metering and interconnection standards in South Carolina published by the South Carolina Energy Office and Office of Regulatory Staff. Included in the appendixes of this document were examples of Duke Power and Progress Energy's net metering policies for certain customers and their respective energy savings.

On-peak/Off-peak and Flat Rates

Currently in South Carolina, there are two main options for net metering customers to choose that will determine their monthly bill. The three IOU companies discussed in this thesis (Progress, Duke, SCE&G) all offer customers the option of a flat rate or a time of use demand payment plan. Santee Cooper however only offers a time-of-use demand rate for its net metering policies, which it calls net billing. A flat rate plan for net metering means that all excess energy generated by the customer at certain times during the month will be paid back to them at the same rate they bought it for.

Additionally, if a customer generates more energy during a month than they consume, the excess energy is carried over and discounted on the next month's electric bill. With a time-of-use demand payment plan, customers are paid the price of their excess energy at the rate in which it was produced, either during on-peak or off-peak hours. If a customer generates more electricity than they consumed for the entire month, they are paid back this excess at the price they charge for off-peak hours.

Duke Power and Progress Energy have a basic facilities charge per month for both flat rate and time-of-use demand customers. South Carolina Energy and Gas does not have demand charges, and Santee Cooper has a demand charge only for their time-of-use demand rate which is the only option available for net billing. There is also a demand charge for time-of-use customers in addition to the basic facilities charge. The on-peak hours that are given for each energy company exclude holidays that these companies treat as off-peak hours.

Duke Power

As of February 12, 2010, there were 22 Duke Power net metering customers in South Carolina, all with PV systems (Heigel, Net Metering Customers). Duke Power's Net Metering Rider allows residential customers with Duke Power to choose any residential rate schedule for their net metering payment structure (Heigel, NM Rider).

Residential flat-rate customers (see appendix d)

Net Metering customers who want a residential flat-rate payment structure can choose the Schedule RS rates, which apply for regular residential service rates

(Residential RS (SC): Residential Service, Duke Energy Carolinas, LLC). There is a basic facilities charge per month of $6.79 for residential flat rate consumers. The current electric rates for Duke Power for residential flat rate users is $.086124 per kWh for first 1000 kWh used per month and $.094067 cents per kWh for all those over 1000 kWh per month.

Residential time-of-use customers (see appendix d)

Residential customers who choose a time-of-use demand payment structure can choose Schedule RT, which contains residential time-of-use rates (Schedule RT (SC): Residential Service, Time-Of-Use, Duke Energy Carolinas, LLC). There is a basic facilities charge of $12.22 for time of use customers every month. The on-peak and off-peak hours are different for summer (June 1-September 30) and winter (October 1-May 31) months at Duke Power. The on-peak demand charge is also different, with a $6.48 demand charge for summer and a $3.24 demand charge for winter. During the summer months, the on-peak energy cost is $.057855 per kWh and the off-peak energy cost is $.047955 per kWh. During the winter months, the on-peak energy cost is $.057855 per kWh and the off-peak cost is $.047955 per kWh. The on-peak hours during the summer hours are 1:00 p.m-7:00 p.m. while the winter hours are from 7:00 a.m.-12:00 p.m. All other hours are off-peak hours, and are charged at a lower rate.

Data from 2008 Report from the South Carolina Energy Office (see appendix e)

The 2008 report about net metering from the South Carolina Energy Office and Office of Regulatory Staff uses actual data from a Duke Power customer with a 2 kW PV system as well as data from a customer with a 6 kW PV system. This data from both

customer a and customer b is then applied to four different scenarios; consisting of data if the customer had: a 2 kW PV system with a flat rate plan, a 2 kW PV system with a time-of-use demand plan, a 6 kW PV system with a flat rate plan, and a 6 kW PV system with a time-of-use demand plan. The data from both customers is initially based on a 2 kW PV system with a flat rate plan. The data for the other options is estimated from this data.

Customer A

The savings rates were calculated for both summer and winter months. For customer A, there were higher savings rates for the 6 kW PV system for both the flat rate and TOUD plans. The 6 kW PV system with a TOUD plan had an average savings rate for both summer and winter months of 37%, up from the average savings rate of 32% for the 6 kW PV system with a flat rate. As for the 2 kW PV systems, the TOUD had a slightly higher annual average savings rate of 16% compared to the 13.5% annual average savings rate. The only difference between the savings rates for the 2 kW PV systems was that the TOUD plan had a slightly higher winter savings rate.

Customer B

As with customer A, the 6 kW PV system resulted in a substantially larger annual average savings rate than the 2 kW PV system. The savings for the 6 kW PV system had similar annual average savings rates, although the flat rate plan had a slightly higher annual average savings rate of 32.5% compared to 30.5% for the TOUD plan. However, there were significant differences between the savings rates during summer and winter for both 6 kW PV system options. The 6 kW PV system with a flat rate had about twice as much savings during the summer months while the 6 kW PV system with a TOUD

plan saved over three times as much during the winter months as during the summer months.

The average annual savings rate for the 2 kW PV system on a TOUD plan had a 19% average annual savings rate while the 2 kW PV system on a flat-rate plan had a 13.5% average annual savings rate. The biggest difference between the flat-rate and TOUD plans for the 2 kW PV systems was that the TOUD plan actually had a negative savings rate during the summer months of negative 10% while the winter months had a 29% savings rate. The flat-rate plan for the 2 kW system was similar for both the winter and summer months.

Progress Energy

As of 2009, there were 2 customers in South Carolina on Progress Energy's net metering program. One customer is a residential customer with a 3 kW solar PV system and the other is a non-residential customer with a 8 kW solar PV system (Anthony, Progress Energy Annual Report). Progress Energy's Rider NM 5 titled "Net Metering for Renewable Energy Facilities" allows net metering customers at Progress Energy to use either a residential flat rate payment structure or a time-or-use demand payment structure (Net Metering for Renewable Facilities: Rider NM-5, Progress Energy).

Residential Flat Rate Customers (see appendix f)

Net Metering customers who choose the standard flat rate residential payment structure are using Schedule RES-13 rates (Residential Service Schedule RES-13, Progress Energy). There is a basic facilities charge of $6.50 per month for both summer

(June-Sept.) and winter (Oct.-May) months. The kWh charge for the summer months was a constant price of $.09573 per kWh. The winter months have a $.09573 per kWh for the first 800 kWh and $.08573 per kWh for anything over 800 kWh per month.

Residential TOUD Customers (see appendix f)

Schedule R-TOUD-13 is the rate program that time-of-use demand net metering customers would choose with Progress Energy (Residential Service Time-of-Use Schedule R-TOUD-13, Progress Energy). There is a basic facilities charge of $9.60 per month for both the summer and winter months. The on peak demand charge for summer months is $5.20 per kW and $3.89 per kW for winter months. The on-peak and off-peak prices are the same per kWh for both the summer and winter months, at $.06758 per kWh for on-peak hours and $.05156 per kWh for off-peak hours. The on-peak hours during the summer months are from 10:00 a.m.-9:00 p.m. Monday through Friday. The on-peak hours during the winter months are from 6:00 a.m.-1:00 p.m. plus 4:00 p.m.-9:00 p.m. Monday through Friday.

Data from 2008 Report from the South Carolina Energy Office (see appendix g)

The South Carolina Energy Office Report from 2008 compared the different metering options (flat-rate and TOUD) with both a 2 kW PV system and a 6 kW PV system. There is one hypothetical customer being used with data applied to both flat-rate and TOUD plans for both a 2 kW PV and 6 kW PV system.

6 kW PV systems

As with the data from Duke Energy, there were higher savings rates for the 6 kW PV systems using both flat-rate and TOUD plans than the 2 kW PV systems. The 6 kW PV system under the flat-rate plan has a slightly higher annual average savings rate of 45% compared to 42% for the 6 kW PV system using a TOUD plan. The only main difference between these two options for a 6 kW PV system is that the flat-rate plan had a significantly higher summer savings rate (59%) than its winter savings rate (45%).

2 kW PV systems

The 2 kW PV system on a TOUD plan had a slightly higher annual savings rate of 21% compared to 16% for the flat-rate plan. The savings rates were similar for both winter and summer months for both options, although the 2 kW PV system under the TOUD plan had a higher winter savings rate than the winter savings rate from the flat-rate option.

South Carolina Energy and Gas

As of 2010, there are 15 South Carolina Energy and Gas net metering customers. 14 of these customers have a PV system while one has a wind turbine. (Gissendanner, Annual Net Metering Report). The rates for either a flat rate residential customer or a time-of-use demand user are specified under the rider labeled "Rider to Residential Rates and Time-of-Use Demand Rate"[3] on the South Carolina Energy and Gas website (Rider to Residential and Time-of-Use Demand Rates, SCE&G Company). This rider allows net metering customers to participate in either a flat rate residential net metering payment structure or a time-of-use demand payment structure.

Residential Flat Rate Customers (see appendix h)

Net metering customers who choose a flat rate payment structure can choose rate 8 for the South Carolina Energy Company, which is a basic residential service payment method (Residential Service Rate 8, SCE&G Company). There is a basic facilities charge of $8.00 for both summer (June-Sept.) and winter (Oct.-May) months for flat-rate customers. The energy charge during the summer months are $.11066 per kWh for the first 800 kWh and $.12173 per kWh for anything over the first 800 kWh. The energy charge during the winter months are $.11066 per kWh for the first 800 kWh and $.10612 per kWh for anything over the first 800 kWh.

Residential TOUD Customers (see appendix h)

Rate 7 of the South Carolina Energy and Gas Company is a time-of-use demand rate schedule that can be used by net metering customers (Rate 7 for Time-of-Use Demand Residential Service, SCE&G Company). There is a basic facilities charge of $12.00 for both summer and winter months for TOUD customers. Unlike Duke Power and Progress Energy, there is not a demand charge for TOUD customers. The charge for on-peak and off-peak hours are the same for both the summer and winter months, with a price of $.24622 per kWh for on-peak kWh and $.08375 per kWh for off-peak kWh. The on-peak hours for the summer months are from 2:00 p.m.-7:00 p.m. Monday-Friday. The on-peak hours for the winter months are from 7:00 a.m.-12:00 p.m. Monday-Friday.

Data for South Carolina Energy and Gas

Customer based data was not available for South Carolina Energy and Gas in the 2008 Report on Net Metering from the South Carolina Energy Office. Therefore, there is

no data available to compare the savings rates from SCE&G's net metering customers to that of Progress or Duke Energy.

Santee Cooper

Santee Cooper's Net Billing Program

Santee Cooper began its net billing program on October 1st, 2007 (Corporate Communications, Santee Cooper). This program is similar to that of the three investor-owned utilities except that it does not offer the option of choosing a flat rate or a time-of-use demand schedule to choose from for the purposes of net metering. Instead, this net billing program offers a time-or-use demand schedule based on on-peak and off-peak hours. As of March 1, 2010, Santee Cooper has 12 net billing customers (Greenway, Net Billing).

Net Billing Rates (see appendix i)

The net billing program for Santee Cooper is based on its net billing rate titled "Schedule RB-09-03" (Residential Net Billing Rate Schedule RB-09-03, Santee Cooper). There is a basic facilities charge each month of $20.00 per month and an on-peak demand charge of $13.66 per KW. The summer months are from May-October, while the winter months are from November-April. The on-peak energy charge during the summer months is $.03585 per kWh while the off-peak energy charge is $.032334 per kWh. The on-peak charge during the winter months is $.04662 per kWh while the off-peak charge is $.04373 per kWh.

The on-peak demand hours during the summer months are from 1:00 p.m. to 10:00 p.m. on Monday through Friday, excluding specified holidays. The on-peak demand hours during the winter months during the winter months are from 6:00 a.m. to 10:00 a.m. on Monday through Friday excluding specified holidays.

Net Billing Customer Data

As mentioned previously, Santee Cooper currently has 12 net billing customers. In addition to these 12 customers there are three customers with PV systems that chose not to participate in the net billing program because of their high kW demands for their energy load. As of March 1, 2010, Santee Cooper has received 1808 kWh during on-peak demand times and 8607 kWh during off-peak hours since the program began back in October of 2007 (Greenway, Net Billing). The size of the photovoltaic systems range from two to 18 kW, with an average of around four kW generating capacity per PV system (Greenway, Net Billing). For a photo of a ground mounted PV solar 4 kW system, see appendix j. For a photo of a utility inverter that is being worked on by Santee Cooper employees, see appendix k.

Conclusion and Recommendations

Conclusion

Drawing comparisons between the four energy utility companies is not as easy as at first anticipated. This is due partially to the fact that net metering is relatively new in South Carolina, and there are not that many net metering customers in total in the state. In addition, the energy companies had different policies for their residential flat rate energy charges; Progress Energy and South Carolina Energy and Gas Company charged

customers per kWh based on an 800 kWh scale, while Duke Power charged customers per kWh based on a 1000 kWh scale. While the three investor owned utility companies had both residential flat rate and time-of-use demand rate options for net metering customers, Santee Cooper had only a time-of-use demand rate option. Santee Cooper referred to their net metering policy as net billing, and only offered a time-of-use demand rate schedule.

Despite the differences between the four energy utility companies, some comparisons can be made between them based on the following factors: facilities charge, demand charge, energy charge, on-peak/off-peak demand hours, and the total number of net metering customers.

Facilities Charge

Overall, Santee Cooper had the highest facilities charge of $20.00 per month. Duke Power and South Carolina Energy and Gas have about the same on average basic facilities charge between residential flat rate and time-of-use demand rate schedules. Progress Energy has the lowest facilities charge for both its residential flat rate and time-of-use demand rate of $6.50 and $9.60 per month respectfully.

Demand Charge

Santee Cooper has the highest demand charge for both summer and winter months of $13.66 per KW for each. Duke Power and Progress Energy have about the same demand charges on average (between summer and winter). South Carolina Energy and Gas Company has the lowest demand charge for both summer and winter seasons since they have no demand charge.

Energy Charge

Since Santee Cooper does not have a residential flat rate option for its net billing program and the energy charge policies differ for residential flat rate consumers between the three investor owned utilities, only the time-of-use demand rates will be discussed in this section. South Carolina Energy and Gas had the highest energy charge for on-peak/off-peak energy per kWh. Santee Cooper had the second highest energy charge rates for on-peak/off-peak energy per kWh, followed by Progress Energy and then Duke Energy which had the lowest overall.

On-Peak/Off-Peak Demand Hours

This section covers how many on-peak hours each energy utility company had for summer and winter months combined. Energy utility companies charge more per kWh for energy consumed during on-peak hours, so it is generally cheaper for a consumer if their energy utility company has less on-peak hours and more off-peak hours. Progress Energy had the highest number of total on-peak hours per day for both summer and winter months with a total of 23 hours (out of 48 hours). Santee Cooper had the second highest number of on-peak hours per day for both summer and winter months with a total of 13 hours. Duke Energy had 11 hours of on-peak energy hours for both summer and winter while South Carolina Energy and Gas had the fewest with only 10 hours.

Number of Net Metering Customers (as of 2010)

Duke Energy has the most net metering customers with 22, all of which use PV systems. The South Carolina Energy and Gas Company has the second highest number of net metering customers with 15, 14 of which own PV systems and one with a wind

turbine. Santee Cooper has the third highest number of net metering customers with 12, all of which own PV systems. And lastly, Progress Energy has the fewest number of net metering customers with only two, one residential with a 3 kW PV system and the other non-residential with an 8 kW PV system.

What does this mean for Santee Cooper?

Overall, Santee Cooper came in third place in regards to the current number of net metering customers, with only 12 in total. Santee Cooper is just behind South Carolina Energy and Gas Company which has 15 net metering customers, even though two Santee Cooper customers currently have large PV systems that are not part of the net billing program. This is primarily because Santee Cooper's net billing program is currently more beneficial to customers with smaller PV systems. Overall, all of the net metering customers with the exception of one own PV systems (the other has a wind turbine).

Review of the data from the SC Energy Office about Duke Power and Progress Energy

After comparing the data from the SC Energy Office about Duke Power and Progress Energy regarding their customers, it has been concluded that Progress Energy had higher savings rates for both its 2 kW and 6 kW PV systems for both flat and time-of-use demand rates. The average savings rates were overall higher for Progress Energy based on this interpretive data provided in appendix F and H of the 2008 South Carolina Energy Office Report on Net Metering in South Carolina.

Recommendations for Santee Cooper

Since South Carolina energy utility companies have only recently begun their net metering and interconnection standards practices, it is important to monitor them on an annual basis. The three investor-owned utility companies had information that was publicly available via the public service commission website of South Carolina. However, Santee Cooper did not have information that was publicly available via the public service commission since it is not an investor-owned utility company and is owned by the state of South Carolina. Contact with Santee Cooper through phone calls was necessary in order to receive information about how many net metering customers there currently are with Santee Cooper. It is recommended that Santee Cooper provide information regarding the number of its net metering customers through its website, so that one does not have to call the company.

Santee Cooper currently only offers a time-of-use demand rate for its customers, whereas the three investor owned utilities discussed previously offer the customer a residential flat-rate and a residential time-of-use demand rate. It may be in Santee Cooper's best interest to try expanding its net billing program to include a residential flat rate option for its current and potential net metering customers. Offering a flat rate option may be preferable for potential or current customers who don't keep up with their on-peak energy charge data and would prefer a more simplistic option. Two of Santee Cooper's customers that own PV systems are not currently part of the net billing program, as they have PV systems that are large in size and the current net billing program does not accommodate them effectively. Therefore, Santee Cooper should consider expanding the scope of its net billing policy to accommodate larger PV system sizes.

Endnotes

1) Arkansas, Florida, Georgia, Kentucky, Louisiana, North Carolina, and South Carolina
2) http://irecusa.org/fileadmin/user_upload/ConnectDocs/IREC_NM_Model_October_2009-1.pdf

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Appendixes

Appendix A

The mission of the **Network for New Energy Choices** is to promote policies that ensure safe, clean, and environmentally responsible energy options.

NNEC collaborates with all levels of government, planning agencies, public interest organizations, government and industry associations, professional societies, labor groups, businesses, and the public.

NNEC, formed in 2006, is a program of GRACE.

http://www.newenergychoices.org/index.php?page=aboutus&sd=no<

Appendix B: Interconnection Best Practices

1) Eligible Technology: Although public policy typically focuses on renewable energy, the system and engineering impacts of a system should be assessed solely on their own merits. To do otherwise introduces complexity and may limit innovation. If a generator complies fully with the relevant technical standards, there is no operational or safety justification to deny it interconnection.

2) Individual System Capacity: Interconnection standards should be less rigid for small, simple systems and more rigid as systems increase in size and complexity. However, standards should also permit systems that are sized to meet even large on-site loads for such applications as hospitals, office parks, and college campuses.

3)"Breakpoints" for Interconnection Process: It is most efficient to break a single overall interconnection process into separate "tracks" based on generator capacity, which relieves complexity for the smallest systems while preserving conservative and thorough studies for larger installations. The emerging consensus is to fragment applicants at four breakpoints: 10 kW, 2 MW, 10 MW (non-exporting systems), and 20 MW.

4) Timelines: Paperwork and permit approvals are time-consuming and present a significant barrier to quick and easy system installation. FERC standards establish a timeline for each step of the application process, for each type of generator. States can elect to reduce the amount of time allowed for the different steps, such as establishing a shorter time allotment for the read-through of an application with small generators using Underwriters Laboratories (UL)-listed equipment.

5) Interconnection Charges: Interconnection processing and study fees can add up to a prohibitive expense, especially for small systems. Additionally, uncapped or unknown fees can make it impossible to obtain financing for larger projects. The FERC standards that establish reasonable fee levels are recommended guidelines for setting fee structure.

6) Engineering Charges: An interconnection standard may require an engineering review for certain systems. When it does, it is important to provide full disclosure of the applicable fees to all involved parties beforehand.

7) External Disconnect Switch: In the event of grid failure, all modern inverters that meet Institute of Electrical and Electronics Engineers (IEEE) standards shut down interconnected systems automatically. Therefore, external disconnect switches are nonessential.

8) Certification: It is important for state decision makers to be cautious when developing policies with certification requirements and ensure that additional technical requirements do not conflict with nationally accepted standards (Underwriters Laboratories, Institute of Electrical and Electronics Engineers). Departure from these standards could affect safety and security of the grid.

9) Technical Screens: The FERC standards provide a thorough set of technical screens that has been copied by many jurisdictions. Any significant revision of these guidelines introduces difficulties to the process, and may increase system costs, because configurations or programming must be changed to differ from these widely used benchmarks.

10) Spot Network Interconnection/Area Network Interconnection: A spot network is designed to serve a large single location, while an area network describes the power distribution system in an area dense with users. These types of networks are designed to increase reliability by creating more potential paths from generation to load.

11) Standard-Form Agreement: It is important to have a standard-form agreement that simplifies the interconnection process. If the standard is too complex or inimical toward the customer, the standard will lose merit.

12) Insurance Requirements: Excessive insurance requirements imposed on customer-sited generators tend to discourage customers from investing in renewable energy systems. Exorbitant premiums could potentially exceed economic benefits derived from having the system.

13) Dispute Resolution: Best standards provide a low-cost means of expert resolution to resolve disputes that evolve in the interconnection process.

14) Rule Coverage: Interconnection standards that apply to all utilities in the state are ideal.

Appendix C

Net Metering Best Practices Nationwide

1) *Individual System Capacity:* Uniform limits in size reduce regulatory confusion, while promoting the widespread population of renewable energy systems. Increasing the eligible facility size for nonresidential systems also could encourage participation in net-metering programs by large investors
2) *Program Capacity Limits:* Capacity limits artificially restrict the expansion of on-site renewable generation and curtail the market for new renewable energy systems. Best practice is to not limit the total aggregate capacity eligible for net metering, either statewide or for individual given utilities.
3) *Rollover Restrictions:* The most effective state programs allow for customers to "roll over" excess generation when they generate more electricity during a monthly billing period than they consume. The utility carries forward any excess generation until it is consumed.
4) *Metering Issues:* As a best practice, customer-sited generators may use their existing meters. When this is not possible, the utility should provide a new meter free of charge. Time-of-use (TOU) meters with time bin carryovers can create situations that reward generators who produce during peak demand periods when electricity is most expensive
5) *Renewable Energy Credit (REC) Ownership:* The best practice for REC ownership allows the owner of the distributed-generation system to maintain ownership of the REC. Ownership provides a potential stream of revenue for owners of systems that generate electricity with renewable resources
6) *Eligible Technology*: All renewable energy technologies and other zero-emissions technologies should be eligible.
7) *Eligible Customers:* There should be no restrictions on eligible classes. Allowing nonresidential customers to net meter is essential to jump-starting new renewable energy markets.

Appendix D

Duke Power Net Metering Rates

	Months	Residential Flat Rate	Residential TOUD Rate
Name of Rate		Schedule RS rate	Schedule RT rate
Facilities Charge		$6.79 per month	$12.22 per month
Demand Charge	Summer (June 1st-Sept. 30th)	-NA-	$6.48 per month
	Winter (Oct. 1-May 31th)	-NA-	$3.24 per month
Energy Charge	Summer	First 1000 kWh- $.086124 per kWh Over 1000 kWh- $.094067 per kWh	On-peak energy charge- $.0557855 Off-peak energy charge- $.047955
	Winter	Same as summer	On-peak energy charge- $.057855 Off-peak energy charge- $.047955
On-peak/ Off-peak demand hours	Summer	-NA-	1:00 pm-7:00 pm Monday through Friday *Excluding holidays*
	Winter	-NA-	7:00 am- 12:00 pm Monday through Friday *Excluding holidays*

Appendix E

Duke Power Customer Data from South Carolina Energy Office

Customer Data	Size of System	Residential Schedule Rate	Season	Savings rate	Average savings rate
Customer A	2 kW PV system	Flat-rate	Summer	18%	13.5%
			Winter	9%	
		TOUD rate	Summer	18%	16%
			Winter	14%	
Customer A	6 kW PV system	Flat-rate	Summer	41%	32%
			Winter	23%	
		TOUD rate	Summer	45%	37%
			Winter	29%	
Customer B	2 kW PV system	Flat-rate	Summer	16%	13.5%
			Winter	11%	
		TOUD rate	Summer	(10)%	9.5%
			Winter	29%	
Customer B	6 kW PV system	Flat-rate	Summer	41%	32.5%
			Winter	24%	
		TOUD rate	Summer	14%	30.5%
			Winter	47%	

Appendix F

Progress Energy Net Metering Rates

	Months	Residential Flat Rate	Residential TOUD Rate
Name of Rate		Schedule RES-13	Schedule R-TOUD-13
Facilities Charge		$6.50 per month	$9.60 per month
Demand Charge	Summer (July-October)	-NA-	$5.20 per month
	Winter (November-June)	-NA-	$3.89 per month
Energy Charge	Summer	Constant price of $.09573 per kWh	On-peak energy charge- $.06758 per kWh Off-peak energy charge- $.05156 per kWh
	Winter	First 800 kWh $.09573 per kWh Over 800 kWh $.08573 per kWh	Same as Summer
On-peak/ Off-peak demand hours	Summer	-NA-	10:00 am- 9:00 pm Monday through Friday *Excluding holidays*
	Winter	-NA-	6:00 am- 1:00 pm and 4:00 pm- 9 pm Monday through Friday *Excluding holidays*

Appendix G

Progress Energy- Data from South Carolina Energy Office

Size of System	Schedule Rate	Season	Savings Rate	Average Savings Rate
2 kW PV system	Flat-rate	Summer	19%	16%
		Winter	14%	
	TOUD rate	Summer	19%	21%
		Winter	23%	
6 kW PV system	Flat-rate	Summer	59%	45%
		Winter	38%	
	TOUD rate	Summer	43%	42%
		Winter	42%	

Appendix H

South Carolina Energy and Gas Company Net Metering Rates

	Months	Residential Flat Rate	Residential TOUD Rate
Name of Rate		Rate 8	Rate 7
Facilities Charge		$8.00 per month	$12.00 per month
Demand Charge	Summer (July-October)	-NA-	None
	Winter (November-June)	-NA-	None
Energy Charge	Summer	First 800 kWh $.11066 per kWh Over 800 kWh $.10612 per kWh	On-peak energy charge- $.24622 per kWh Off-peak energy charge- $.08375 per kWh
	Winter	First 800 kWh $.11066 per kWh Over 800 kWh $.10612 per kWh	Same as Summer
On-peak/ Off-peak demand hours	Summer	-NA-	2:00 pm- 7:00 pm Monday through Friday *Excluding holidays*
	Winter	-NA-	7:00 am- 12:00 pm Monday through Friday *Excluding holidays*

Appendix I

Santee Cooper Net Metering Rates

	Months	Net Billing Rate
Name of Rate		RB-09-03
Facilities Charge		$20.00 per month
Demand Charge	Summer (July-October)	$13.66 per KW
	Winter (November-June)	Same as Summer
Energy Charge	Summer	On-peak energy charge- $.03585 per kWh Off-peak energy charge- $.032334 per kWh
	Winter	On-peak energy charge- $.04662 per kWh Off-peak energy charge- $.04373 per kWh
On-peak/ Off-peak demand hours	Summer	1:00 pm- 10:00 pm Monday through Friday *Excluding holidays*
	Winter	6:00 am- 10:00 am Monday through Friday *Excluding holidays*

Appendix J

4 kW ground mounted PV system for Santee Cooper

Appendix K

Utility Inverter undergoing maintenance by Santee Cooper employees