

# A Residential Customer Guide to Going Solar: Duke Energy Progress Version

Prepared by the



for Duke Energy Progress Residential Customers



**T**hroughout its history, North Carolina has been at the forefront of technological change and innovation. Innovative advances in fields such as biotechnology, nanotechnology, computing, textile engineering, crop sciences, and data science have improved the lives of millions of North Carolina citizens, and created hundreds of thousands of jobs.

Clean energy technologies have also made innovative advances, and are poised to help North Carolina residents save millions of dollars on their monthly utility bills. For example, the cost of installing solar photovoltaic (PV) panels on a home has fallen to the point that millions of Americans now have the opportunity to reduce their electric bills and more affordably generate their own energy. On top of these lower installation costs, there are several federal, state, and utility financial incentives available to North Carolina homeowners to make solar a more cost-effective energy option.

Installing solar also decreases costs for everyone because when a homeowner uses less energy from the grid, the utility can avoid investing in new power plants and other costly infrastructure. Delaying these investments delays or removes the need for rate increases. Solar also increases the efficiency of the grid, which reduces other fuel and operating costs that utilities pass on to their customers.

This guide is designed to help North Carolina residents looking to invest in solar and take a larger measure of control over their energy production and energy future. Even if the readers of this guide choose not to invest in solar at all, the staff of the North Carolina Solar Center hope the people living in Duke Energy Progress' service territory will use this guide to help understand their options and become educated solar consumers.

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# Glossary

**Avoided Cost-** price the utility would have to pay to purchase another unit of energy based on their current generation portfolio; avoided cost is lower than the retail rate because it does not include delivery (transmission and distribution) or customer charges

**Buy-All, Sell-All-** arrangement in which a PV owner sells all of the electricity produced by their system to the utility and purchases all of the electricity they consume from the utility

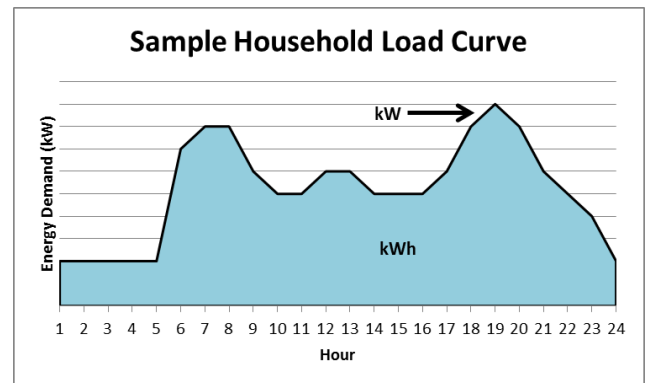
**Demand Charge-** charge on a customer's utility bill for the maximum level of power (kW) used during the month; this reflects how much energy was being used at that single moment

**Flat Rates-** rates that do not fluctuate based on time of day or day of week; the same price is charged for all energy used

**Kilowatt (kW)-** unit of power; amount of power being consumed or produced at a single instant in time (see graph to right- kW are represented by the black line)

**Kilowatt-hour (kWh)-** unit of energy; amount of power used or generated over time (see graph to right- kWh are represented by the blue shaded area)

**Net Metering-** arrangement in which a homeowner with solar panels uses the energy produced by his or her system and sells any extra energy back to the grid at the retail rate for others to use



*kW versus kWh*

**Off-Peak Energy-** energy produced or consumed during periods of low demand (in the middle of the night and on weekends, for example)

**On-Peak Energy-** energy produced or consumed during the periods of highest demand (time when people are using the most energy, such as hot summer days when many people are using air conditioners)

**Renewable Attributes-** a quality of energy based on the fact that it was generated from renewable sources; the renewable attributes of energy can be financially separated from the physical energy and traded as RECs

**Renewable Energy Certificate (REC)-** accounting mechanism for the renewable attributes of energy generated from renewable sources; one REC represents one megawatt-hour of renewable energy

**Renewable Energy and Energy Efficiency Portfolio Standard-** North Carolina law requiring Duke Energy Progress to obtain 12.5% of its electricity from renewable and energy efficiency sources by the year 2021

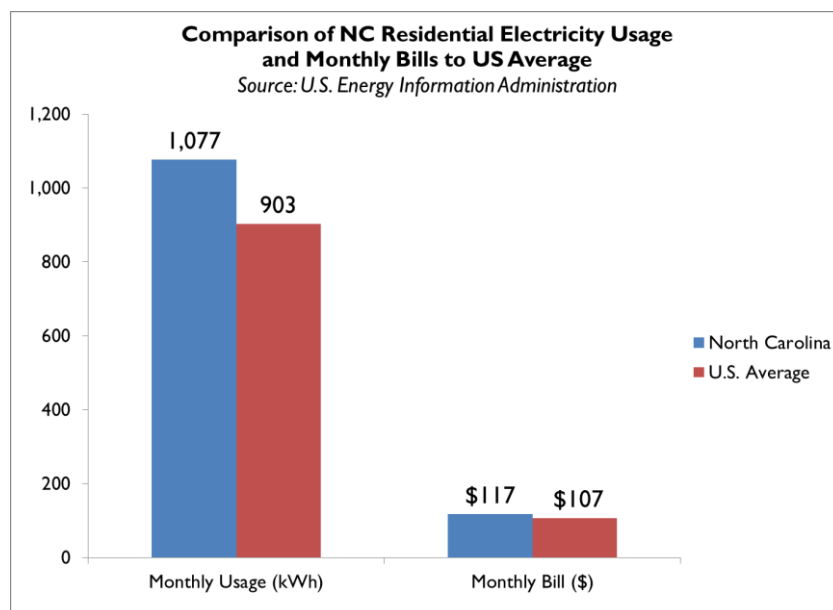
**Retail Rate-** the price at which a kWh of energy is selling for on a given tariff

**Tariff-** a utility's publicly posted schedule of rates; Duke Energy Progress has multiple tariffs for residential customers to choose from, such as the standard flat rate tariff and the time-of-use tariff

**Time-of-Use Rates-** rates that vary based on time of day and day of week; energy used during "on-peak" hours costs more than energy used during "off-peak" hours

## Efficiency First

North Carolina residents both consume more energy and spend more money on energy than the national average, despite having lower rates.<sup>1</sup> Because of this, North Carolina residents in particular benefit financially from energy saving measures like replacing insulation, replacing inefficient appliances and lighting, and installing solar panels. While all of these measures reduce electricity consumption, efficiency improvements tend to provide a homeowner with the greatest bang for their buck. Improving efficiency before installing solar panels also allows a PV system to make a greater impact on the owner's electric bill. Because the home uses energy produced from the PV system more efficiently, the homeowner will require even less energy from the grid.



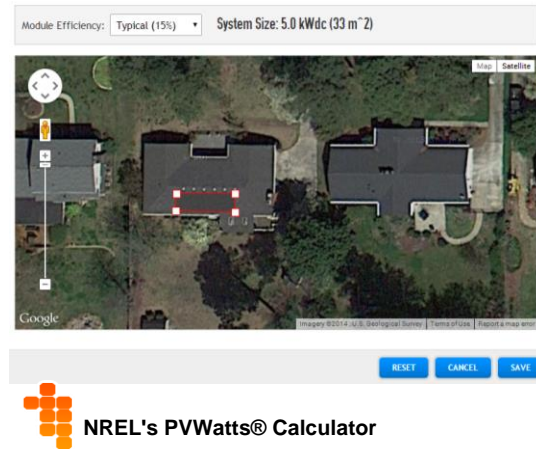
**Figure 1: Comparison of NC Electricity & Monthly Bills to US Average**

For this reason, as they are deciding whether or not to install solar PV, customers should consider having a full-spectrum home energy audit completed. An energy audit is a professional examination of how a customer's home uses energy and where efficiency improvements can be made. Duke Energy Progress offers a free energy audit questionnaire online to all of its customers. To take the energy audit questionnaire, visit <https://www.progress-energy.com/carolinas/home/save-energy-money/energy-efficiency-improvements/cher/index.page>. In addition, several solar companies in the Triangle that offer home energy retrofits also offer free home energy audits. To find such a company, please call the NC Sustainable Energy Association. Their contact information is on page 20 of this guide.

<sup>1</sup> U.S. EIA. Electric Sales, Revenue, and Average Price: Table T5.a. Available at [http://www.eia.gov/electricity/sales\\_revenue\\_price/`](http://www.eia.gov/electricity/sales_revenue_price/)

## How Much Energy Can Solar Generate At My House?

Fortunately, a homeowner does not need an ideally faced and sloped roof to produce lots of solar power. In fact, in North Carolina, panels installed on east or west facing roofs receive about 85% as much solar energy as an ideally oriented south-facing roof. The impact of less than ideal roof pitch is even lower. The U.S. Department of Energy's National Renewable Energy Laboratory (NREL) has a very useful online tool called PV Watts<sup>2</sup> that allows a homeowner to see their roof in a satellite photo and draw in the area for a solar system. PV Watts will then estimate how much energy the PV system will produce in a typical year and provide a monthly breakdown.



The average household in North Carolina used an average of 1,077 kWh per month in 2012. Assuming a SE or SW facing roof with no shade, a 9.5 kW PV system is required to generate 100% of this average home's electricity use in a typical year. Thus, the 4 kW system used as an example in this guide would provide about 42% of the electricity needs for this home.<sup>3</sup>

## What Do I Need to Know About Today's Solar Technology?

A residential solar PV system consists of three major components: (1) solar panels (modules), (2) an inverter, and (3) racking. Today there are many trusted brands of solar panels, with limited differences in quality, features, and performance between most typical-efficiency panels. All reputable panels will come with a 25-year power warranty that generally guarantees that the panels will still produce at least 80% of their initial nameplate rating 25 years from now. A great resource to learn more about current products and technologies is Home Power magazine<sup>4</sup>, which offers many free articles on its website.

Traditionally, a group of solar panels are connected in a series (to form a "string" of panels) and then connected to a string inverter. These string inverters are still the lowest cost solution, but are more sensitive to partial panel shading than microinverters or inverters with DC optimizers. Solar PV systems are quite sensitive to shading, even partial shading, but both microinverters and DC optimizers limit the effect of shade to only the shaded panel, instead of the entire string of panels. This can result in 20% greater annual energy output in some situations.

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<sup>2</sup> <http://pvwatts.nrel.gov/>

<sup>3</sup> kW values here are DC-rated

<sup>4</sup> <http://www.homepower.com/solar-electricity>

## ***How Does Solar PV Help Customers Save Money?***

There are three primary ways a home can use the power generated by a photovoltaic (PV) system: 1) Using the electricity on-site and selling any excess back to Duke Energy Progress via net metering, 2) Selling all the electricity and renewable attributes produced via NC GreenPower, and 3) Using the PV system to supply an energy storage system (such as a battery backup system).

Each option is accompanied by its own set of complexities and economic benefits. In some cases, choosing one option may disqualify a homeowner from some of the available financial incentives discussed later in this guide. Customers should discuss these options with their solar installer to make sure they pick the best option for their home.

### *Net Metering*

At the moment when the sun's rays are striking a solar PV system, and a residential customer's home is wired to directly use the electricity generated by the system, the customer is able to avoid using that amount of energy from Duke Energy Progress. During times when the sun is shining, the solar PV system is acting in a way that is very similar to any other appliance that helps customers save energy, like an ENERGY STAR certified HVAC system or clothes washer.

Just like with an energy efficient appliance or other similar measure, the self-supply characteristics of solar PV help customers save on their bill at the retail rate they pay for electricity from Duke Energy Progress, since the amount of energy their system generates in kilowatt-hours will reduce their demand for energy from the utility.

In the case of net metering, a rooftop solar PV system may sometimes generate more energy than the customer needs at that moment. This means that two things are happening:

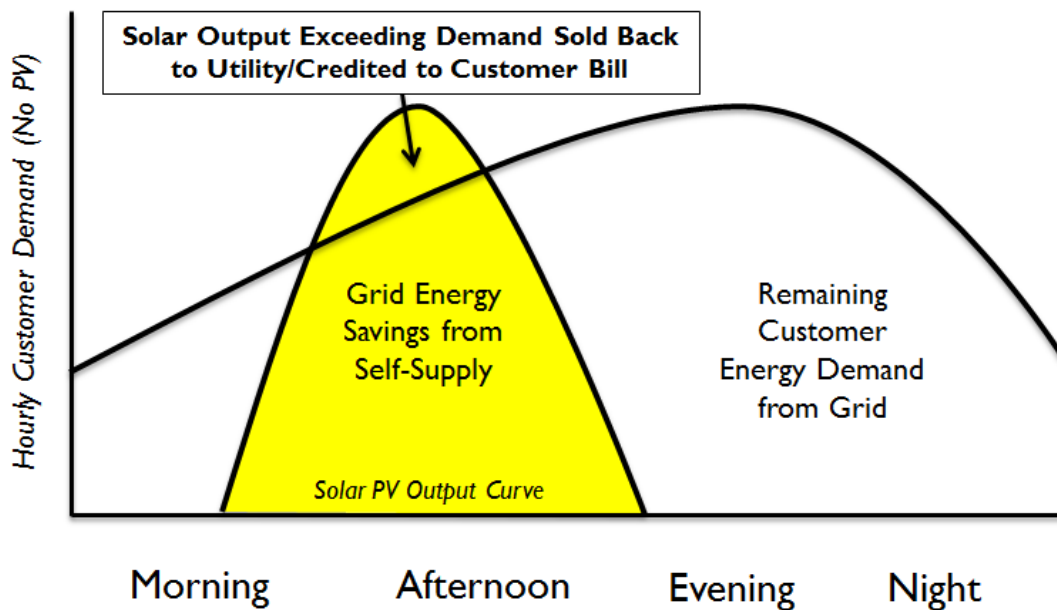
- The PV system is still supplying the customer with the energy it needs; and
- The PV system is also **exporting** the excess energy back into the utility grid, which has the effect of supplying nearby customers with electricity

Net metering allows customers to power their homes with a solar PV system when the sun is shining, but still receive credit at the retail rate for generating more energy than they need, which will offset their bill during times when the sun is not shining. When extra electricity is produced by their systems, it is exported to the grid for others to use, "spinning the meter backwards" in the process. The solar PV customer's utility bill at the end of the month reflects the net amount of electricity used, or the difference between the total amount of energy the customer consumed and what the customer's PV system generated.

If the system produces more electricity than it uses in a given month, the "net excess generation" turns into credits carried forward into the following month like rollover minutes

for a cellular phone plan. Net excess generation credits can be carried forward from month-to-month until May 31<sup>st</sup> of each year, when all credit is cleared with no compensation to the customer. Net metering may be used in combination with the Duke Energy Progress SunSense Program, which this guide will touch on later.

## Selling Energy Back to the Utility: Net Metering



**Figure 2: Visual Representation of Net Metering**

Duke Energy Progress offers four main residential rate schedules for customers who want to net meter – (1) a **standard flat rate schedule (RES)**, (2) a **time-of-use schedule (TOU)**, (3) a **time-of-use demand schedule (TOU-D)** and (4) a **time-of-use all-energy schedule (TOU-E)**. North Carolina’s net metering rules allow PV owners to participate in net metering under any of these rate schedules, but Duke Energy Progress requires its residential customers to be on the time-of-use demand rate schedule to participate in the SunSense Program (see Page 13). Under the standard schedule, customers pay a single rate for all electricity consumed.<sup>5</sup> Under all of the time-of-use schedules, the rate varies by time of day and day of the week. Electricity consumed during hours classified as “on-peak” costs more than electricity consumed during “off-peak” hours. The time-of-use schedule (number 2 above) also classifies some hours as “shoulder”, which is in between on-peak and off-peak. In addition to these rates, customers on the time-of-use demand schedule pay a demand charge each month, which reflects their peak usage that month. These customers pay a lower rate for both on-peak and off-peak energy, though. Customers on the time-of-use all-energy schedule do not pay a

<sup>5</sup> While all electricity consumed per month is charged the same rate under the standard flat rate schedule, this rate changes seasonally, with a higher rate being charged during the months of July through October.



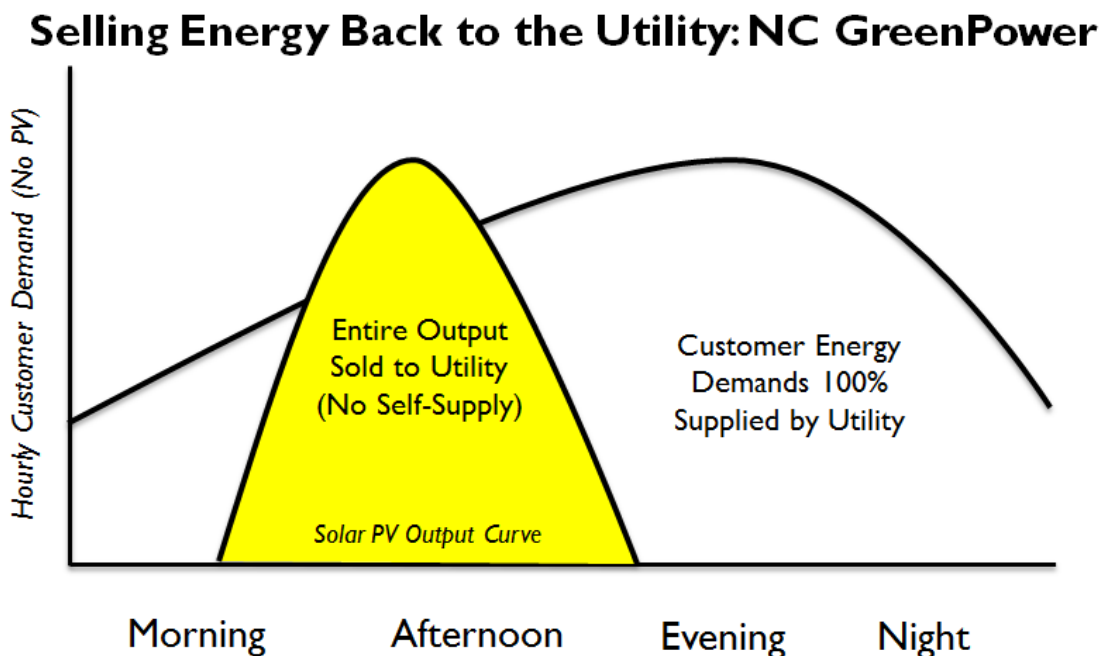
demand charge, but pay a higher rate for on-peak energy. See Table 6 in the Appendix for more information on Duke Energy Progress' rate options.

### NC GreenPower

Unlike net metering, NC GreenPower requires a “buy-all, sell-all” agreement between a customer and the utility, meaning that the customer agrees to sell all electricity generated by their PV system to the utility at a set rate and to continue to buy all of the electricity they will consume from the utility.

NC GreenPower participants sell their power under the Cogeneration and Small Power Producer (CSP) tariff, which offers an avoided cost rate for power sold to Duke Energy Progress. “Avoided cost” refers to the price that Duke Energy Progress would have to pay to get the energy it is purchasing from that customer from another source. Participants have two options, A and B, under this tariff. These options vary based on which hours are categorized as “on-peak” and “off-peak”, as well as the rates offered for on-peak and off-peak energy.

On top of this avoided cost rate, NC GreenPower participants get paid a premium for the power they produce, due to its “renewable attributes”. This premium is \$0.06 per kWh and is only paid for 5 years. NC GreenPower may not be used in combination with net metering or other utility incentives, like the Duke Energy Progress SunSense program. It is important to note that money earned under the NC GreenPower option is classified as income, and therefore subject to income tax.



**Figure 3: Visual Representation of NC GreenPower**

### **Battery Backup**

Connecting a PV system to batteries may make sense for customers in remote locations that are not connected to the grid, or for customers whose utility does not offer net metering or NC GreenPower. However, batteries can add significant cost to a system, and require a level of maintenance that would be unattractive to most homeowners.

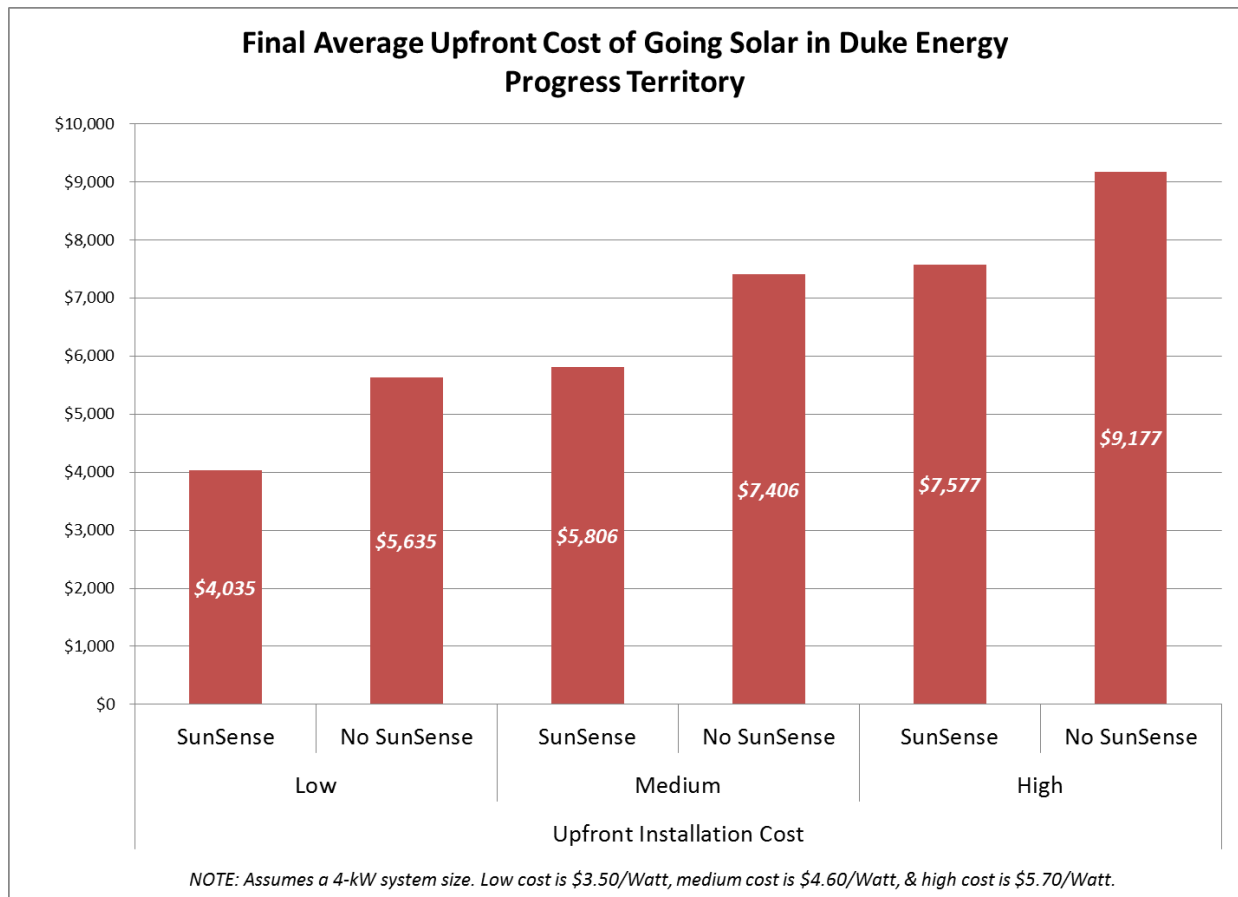
In most cases, net metering or NC GreenPower would be more advantageous ways to benefit from a PV system.

### **Putting it All Together**

Tables 5 and 6 in the appendix compare the different basic rate and billing options available. Homeowners may only select one of the three options presented in Table 5: NC GreenPower, net metering with SunSense or net metering without SunSense. The chart details payments and bill credits included in each option, the ability to roll over energy credits from month to month if a customer's solar PV system causes them to "zero out" their Progress bill, the time limits on incentives, and interconnection fees. REC (Renewable Energy Certificate) ownership is also noted. RECs are the accounting mechanism used to ensure utilities meet the state Renewable Energy and Energy Efficiency Portfolio Standard (REPS) requirements and allow for trading to occur to meet these requirements. Finally, rate schedule options are listed for each of the incentive choices. This is particularly important for those homeowners wishing to participate in the SunSense program.

## How Much Does Solar PV Really Cost?

One of the most significant misconceptions about solar is that it is prohibitively expensive and is not a good investment for all but a few homeowners. In fact, the cost of PV has decreased by over 50% in the last 2-3 years. As Figure 4 shows, the average cost (after incentives) of a system to serve an average home in Duke Energy Progress territory ranges from **just \$4,035 to \$9,177!**<sup>6</sup>



**Figure 4: Average Post-Incentive Upfront Costs of Solar PV**

### Financing Options

There are a number of different financing options available if customers do not have the cash upfront to pay for a solar PV system. Many local banks and credit unions provide low-interest loans to people going solar. Another option to finance the costs of a PV system is to borrow

<sup>6</sup> This figure is based upon a system size of 4 kW and a cost of \$3.50 to \$5.70 per watt. Cost figures were obtained from conversations with local solar installers and LBNL's *Tracking the Sun VI* report. (Lawrence Berkeley National Laboratory. *Tracking the Sun VI: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2012*. Accessible at: <http://emp.lbl.gov/sites/all/files/lbnl-6350e.pdf>.)

against the equity of one's home, taking out what is known as a home equity loan. While these options reduce or eliminate the upfront costs of going solar, it is important to note that taking out a loan will increase the total cost of owning the system, due to interest. However, with these options, solar is accessible to more people, and with all of the upfront incentives available, the dollar amounts of these loans are less than, for example, the typical car loan.

## What Kind of Federal, State and Utility Incentives are Available?

There are several key federal, state and utility incentives that help to reduce or “buy down” the upfront cost of a residential rooftop PV system and/or provide a short-term credit on a Duke Energy Progress customer’s utility bill. These incentives are described in detail below.

### Federal and State Incentives

The main upfront incentives for individuals trying to go solar are federal and state tax credits. The Federal Residential Renewable Energy Tax Credit provides a taxpayer with a credit for 30% of his or her solar installation costs. There is no cap on the amount of this tax credit, and it is available for solar installations placed in service by December 31, 2016. The North Carolina State Renewable Energy Tax Credit provides a taxpayer with a credit for 35% of his or her solar installation costs. This credit is available for solar installations placed in service by December 31, 2015 and may be carried over for 5 tax years.<sup>7</sup>

Together, these two tax credits alone bring down a homeowner’s cost of installing solar significantly. Due to tax implications explained below, the effective cost reduction is about 60%.

Federal and State Solar PV Tax Credits Available to NC Residents					
Tax Credit Type	Credit Amount	Total Credit Maximum	Annual Credit Limitation	Credit Rollover	Expiration Date
Federal Tax Credit	30% Installation costs	None	Total federal tax liability for that year	Until credit expiration-rollover is uncertain after this date	12/31/2016
State Tax Credit	35% Installation costs	\$10,500	50% state tax liability for that year	Up to 5 years	12/31/2015
Source: <a href="http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC20F&amp;re=0&amp;ee=0">Database of State Incentives for Renewables and Efficiency (DSIRE)</a>					

**Table 1: Federal/State Solar PV Tax Credit Information**

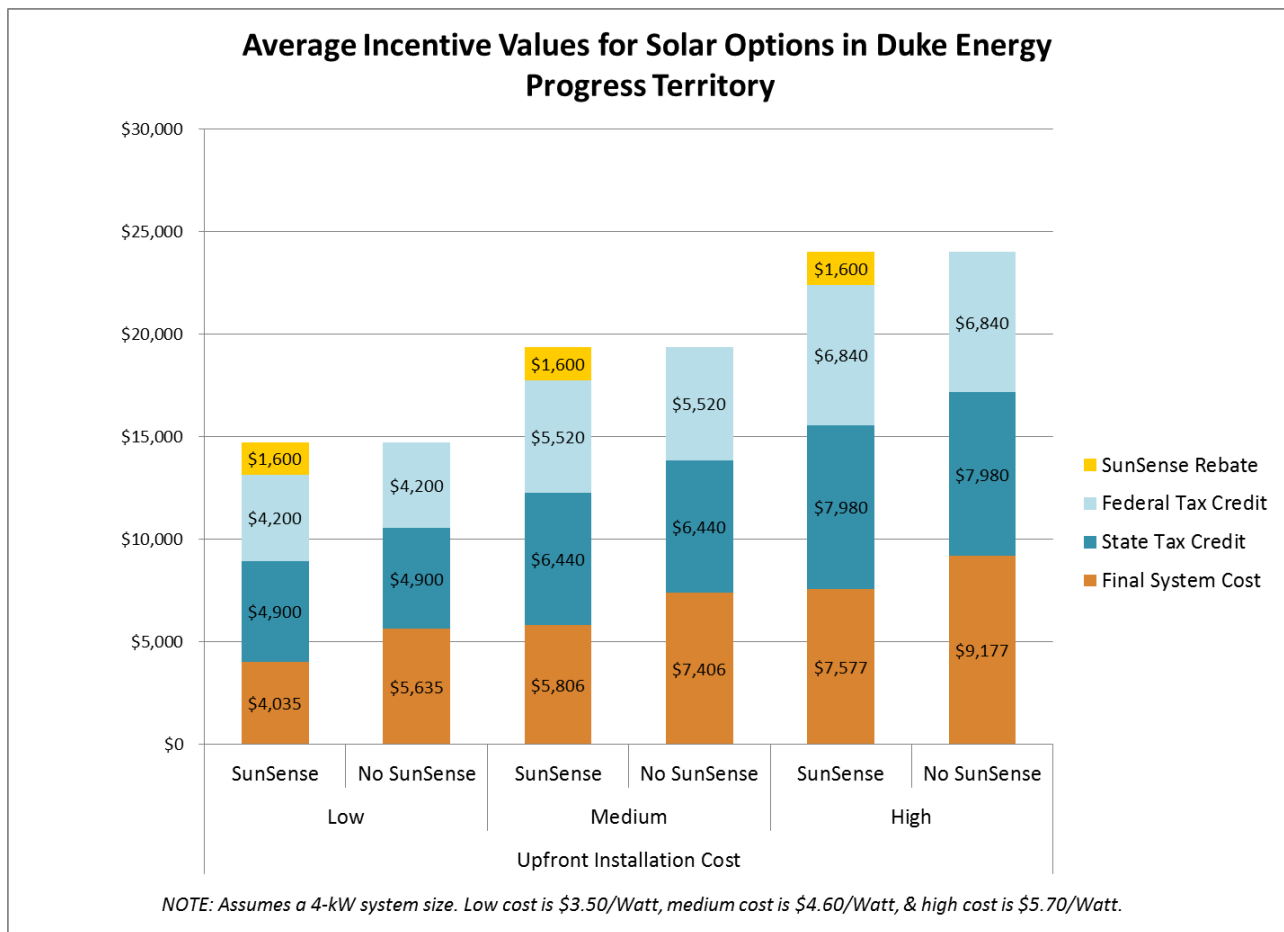
### Utility Incentives

The next type of solar PV incentive available to homeowners is **Duke Energy Progress’ SunSense Program**. SunSense is an incentive program available to Duke Energy Progress customers that reduces the upfront costs of solar in addition to providing participants with a monthly bill credit based on the size of their system.

<sup>7</sup> Database of State Incentives for Renewables and Efficiency (DSIRE), [http://dsireusa.org/incentives/incentive.cfm?Incentive\\_Code=NC20F&re=0&ee=0](http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC20F&re=0&ee=0)

SunSense program participants receive a rebate of \$500 per kW installed, as well as an ongoing monthly credit of \$4.50 per kW installed for five years.<sup>8</sup> SunSense participants must be on Duke Energy Progress' time-of-use demand rate schedule (TOU-D). The annual budget for SunSense is limited to 1 megawatt (MW) of systems, and incentives are given on a first-come, first-serve basis. Interested customers can see the current remaining capacity in the budget on the SunSense website: <https://www.progress-energy.com/carolinas/home/save-energy-money/energy-efficiency-improvements/sunsense/solar-pv.page>.

Putting it All Together



**Figure 5: Expected Incentive Breakdown for DEP Customers**

A sample breakdown of the incentives available to homeowners in Duke Energy Progress territory is shown in Figure 5 above. The calculations are based upon a 4 kW-sized system. To reflect variation in the cost of PV systems, low, medium, and high cost scenarios are presented in figures 4 and 5. The low cost scenario represents a system cost of \$3.50 per watt, which was obtained through conversations with local solar installers. The high cost scenario (\$5.70 per

<sup>8</sup> SunSense rebate and monthly credits are based on AC capacity

watt) is based upon Lawrence Berkeley National Laboratory's 2012 average North Carolina residential solar installation cost from their *Tracking the Sun VI* report. This is used as the high scenario because prices have already declined since 2012, and local installers indicate that this figure now represents a higher end cost. The medium cost scenario splits the difference between the low and high cases, equaling \$4.60 per watt.

The 30% federal tax credit and the 35% state tax credit offset a large portion of the system costs once the year's tax refund is received. However, because the state tax that a consumer pays is a federal tax deduction, the state tax credit received eliminates a portion of this federal tax deduction, increasing one's federal taxable income by the amount of the state tax credit. This has the net effect of increasing one's federal income tax bill by their marginal tax rate times the value of the state tax credit received. For example, for someone in the 15% tax bracket, their federal income tax bill increases by 15% of the state tax credit.

This leaves the customer with an average total cost of just \$7,591, a discount of 60%! Customers that choose to participate in Duke Energy Progress' SunSense program are left with an even lower average final cost of \$5,806, a discount of 68%! These numbers will certainly vary based upon system size, system cost, payment terms, and a variety of other factors, but they show just how big of a difference these incentives make. While the customer in this example is still left with a cost ranging from \$4,035 to \$9,177 after upfront incentives are received, this remaining cost may be recouped over time through net metering or NC GreenPower.

## How Do All of These Options Compare?

This section compares these options using the energy usage patterns of a typical household in Raleigh, Wilmington, and Asheville. While actual savings will vary widely depending upon how much electricity customers use and when they use it, these estimates provide a good example of bill savings for a typical person with an average-sized residential PV system in the portions of North Carolina served by Duke Energy Progress.

**\*\*\*\* DISCLAIMER: The figures presented below are estimates based on average PV output and energy usage data. Individual customer savings may vary significantly from those in the example below. \*\*\*\***

<b>Average Monthly Bill Savings Over PV System Life Under Rate/Billing Options</b>				
<b>Rate/Billing Option</b>	<b>City</b>	<b>Average Flat Rate Bill Before PV</b>	<b>Average Bill After PV</b>	<b>Monthly Savings</b>
<i>Net Metering (Flat Rate)</i>	Raleigh	\$149.01	\$97.91	<b>\$51.10</b>
	Wilmington	\$172.57	\$122.01	<b>\$50.56</b>
	Asheville	\$140.91	\$90.35	<b>\$50.56</b>
<i>Net Metering (Time-of-Use All-Energy Rate)</i>	Raleigh	\$149.01	\$97.11	<b>\$51.90</b>
	Wilmington	\$172.57	\$117.33	<b>\$55.24</b>
	Asheville	\$140.91	\$86.81	<b>\$54.10</b>
<i>Net Metering (Time-of-Use Rate)</i>	Raleigh	\$149.01	\$96.08	<b>\$52.93</b>
	Wilmington	\$172.57	\$119.18	<b>\$53.39</b>
	Asheville	\$140.91	\$85.61	<b>\$55.30</b>
<i>SunSense (Time-of-Use Demand Rate)</i>	Raleigh	\$149.01	\$114.56	<b>\$34.45</b>
	Wilmington	\$172.57	\$145.07	<b>\$27.50</b>
	Asheville	\$140.91	\$105.34	<b>\$35.57</b>
<i>NC GreenPower Option A*</i>	Raleigh	\$149.01	\$128.14	<b>\$20.87</b>
	Wilmington	\$172.57	\$151.52	<b>\$21.05</b>
	Asheville	\$140.91	\$119.33	<b>\$21.58</b>
<i>NC GreenPower Option B*</i>	Raleigh	\$149.01	\$127.74	<b>\$21.27</b>
	Wilmington	\$172.57	\$151.17	<b>\$21.40</b>
	Asheville	\$140.91	\$119.04	<b>\$21.87</b>

\*NC GreenPower does not technically reduce a customer's monthly electric bill, as it is a buy-all/sell-all agreement. Because NC GreenPower is a 5 year agreement, no NC GreenPower income is included after year 5. In this example, the payment received for selling all energy and RECs (5 yrs) is shown as savings to illustrate the value received through participation in the program NC GreenPower income is also subject to federal and state income tax, thus reducing these initial "savings"; \*\*Monthly bills for the full 25 years of PV use were averaged.

**Table 2: Average Monthly Bills Before and After Going Solar**



Estimated Savings for a Typical Customer

There are both advantages and disadvantages to the different performance-based payment options and rate schedules available. People who use a lot of electricity at once or use most of their electricity during on-peak hours (see Table 6 in the appendix) will see higher electricity bills on a time-of-use rate schedule than with flat rates. People who stagger the use of appliances that consume a lot of energy, use natural gas for heating or water heating, or use most of their electricity at night or on the weekend can see lower electricity bills with time-of-use rates. Therefore, savings are highly dependent upon individual energy usage patterns.

The savings shown in Tables 2 and 3 were calculated using typical energy usage data and PV output data for a 4 kW-sized system in Duke Energy Progress territory. Output data was obtained from NREL’s PV Watts tool for the cities of Raleigh, Wilmington, and Asheville, and energy usage data was taken from NREL’s dataset entitled “Commercial and Residential Hourly Load Profiles for all TMY3 Locations in the United States”.

<b>Net Savings Over PV System Useful Life</b>				
<b>Rate/Billing Option</b>	<b>City</b>	<b>Net Savings After 25 Years</b>		
		<b>Low System Cost</b>	<b>Medium System Cost</b>	<b>High System Cost</b>
<i>SunSense (Time-of-Use Demand Rate)</i>	Raleigh	\$6,301	\$4,530	\$2,759
	Wilmington	\$4,221	\$2,450	\$679
	Asheville	\$6,635	\$4,864	\$3,093
<i>Net Metering (Time-of-Use All-Energy Rate)</i>	Raleigh	\$9,935	\$8,164	\$6,393
	Wilmington	\$10,943	\$9,172	\$7,401
	Asheville	\$10,594	\$8,823	\$7,052
<i>Net Metering (Time-of-Use Rate)</i>	Raleigh	\$10,244	\$8,473	\$6,702
	Wilmington	\$10,389	\$8,618	\$6,847
	Asheville	\$10,955	\$9,184	\$7,413
<i>Net Metering (Flat Rate)</i>	Raleigh	\$9,694	\$7,923	\$6,152
	Wilmington	\$9,534	\$7,763	\$5,992
	Asheville	\$9,392	\$7,576	\$5,761
<i>NC GreenPower Option A</i>	Raleigh	\$625	-\$1,146	-\$2,917
	Wilmington	\$679	-\$1,092	-\$2,863
	Asheville	\$700	-\$1,116	-\$2,931
<i>NC GreenPower Option B</i>	Raleigh	\$747	-\$1,024	-\$2,795
	Wilmington	\$785	-\$986	-\$2,757
	Asheville	\$785	-\$1,031	-\$2,846

\*NOTE: Negative savings reflect upfront costs not recouped over the PV system’s life.

**Table 3: Net Savings Over 25-Year Useful Life**

Table 2 shows estimated monthly bill savings for each of the different performance-based payment choices paired with its available rate options<sup>9</sup>. Savings for each option are based upon what the customer would otherwise be paying under the standard flat rate schedule with no PV system in place. The figures in Table 2 are averages of monthly savings calculated over the entire life of the PV system (25 years). As the savings are averaged over 25 years and assume a 2% annual increase in electricity costs, the bill amounts may appear higher than a typical customer’s bill today. Savings will vary from month to month and over the years, but these estimates provide a useful comparison between the available options.

Table 3 displays estimated total savings for a PV system in Raleigh, Wilmington, and Asheville under each of the different billing options. In this example, net metering under the flat rate, time-of-use, and time-of-use all-energy schedules are the most favorable options. As the results show, the rate option a customer chooses can have a significant impact on whether solar PV is a good investment for them.

NC GreenPower has the advantage of paying customers a premium for their RECs for the first five years, which can also help pay back the costs of the system quickly and reduce interest payments. However, it does not provide as much savings over the life of the system as the other options, since the NC GreenPower credit is limited to 5 years, and the amount each system is paid is renewed only at the discretion of the program.

<b>Inflation-Adjusted Return on Investment (ROI)</b>				
<b>Rate/Billing Option</b>	<b>City</b>	<b>Low System Cost</b>	<b>Medium System Cost</b>	<b>High System Cost</b>
<i>Net Metering (Flat Rate)</i>	Raleigh	65%	25%	1%
	Wilmington	63%	24%	0%
	Asheville	63%	24%	0%
<i>Net Metering (Time-of-Use All-Energy Rate)</i>	Raleigh	67%	27%	3%
	Wilmington	78%	35%	9%
	Asheville	74%	33%	7%
<i>Net Metering (Time-of-Use Rate)</i>	Raleigh	71%	30%	5%
	Wilmington	72%	31%	6%
	Asheville	78%	36%	9%
<i>SunSense (Time-of-Use Demand Rate)</i>	Raleigh	55%	8%	-17%
	Wilmington	24%	-14%	-34%
	Asheville	60%	11%	-15%

*An annual inflation rate of 2.03% was used for this calculation. This rate of inflation is the annual average inflation rate for 2004-2014, as measured by the U.S. Bureau of Labor Statistics. The cost of financing a system with low- or no-money down may increase overall cost of ownership, and reduce system ROI.*

**Table 4: Inflation-Adjusted Return on Investment**

<sup>9</sup> Net metering is also available with the TOUD tariff. Savings under the TOUD tariff were omitted, as the SunSense option already reflects the savings of net metering under the TOUD tariff.

Net metering under the flat rate schedule pays the same amount for all energy sold to the grid, no matter the time of day. The advantages of this option are that it lets the customer earn a higher rate for energy produced during off-peak hours than he or she would get on any of the time-of-use schedules, avoid paying a demand charge, and avoid paying a higher rate for on-peak energy use. This is an attractive option if a homeowner consumes a lot of energy at once or uses a lot of energy during on-peak hours (see Table 6 for more information on on-peak hours).

For the options of net metering under the time-of-use (TOU) and time-of-use all-energy (TOU-E) schedules, a homeowner's energy usage patterns will have a significant impact on how much he or she saves. Net metering under both schedules has the advantage of paying a significantly higher price for electricity generated during on-peak hours. However, if a customer consumes a lot of energy during on-peak hours, he or she will also have to pay this same higher price for on-peak energy taken from the grid. The TOU schedule charges a higher rate for on-peak energy than the TOU-E schedule, so this effect is more pronounced. The TOU schedule also offers a shoulder rate (between on-peak and off-peak), which provides more opportunity for a customer to avoid on-peak energy consumption, but provides fewer hours for a customer to get paid the maximum on-peak rate for energy generated by their PV system. An advantage of both the TOU and TOU-E rate schedules over the time-of-use demand (TOU-D) schedule is that there is no demand charge. Therefore, a homeowner gets the time-of-use advantage of a higher rate for on-peak PV generation without the burden of a demand charge.

The SunSense option is essentially net metering under the TOU-D schedule with an extra upfront and monthly incentive payment. This option pays a lower rate for electricity sold to the grid during both on- and off-peak hours. However, if a homeowner is very conservative with how much energy he or she uses at once, this option could result in overall savings. The greatest advantages of the SunSense program are the reduced upfront cost and the five-year monthly payment based on system size.

When deciding which option to go with, customers should think about their typical usage patterns and consider the estimates provided by a qualified and knowledgeable solar company to select the option that is best for them.

## What Can I Do to Get Started?

The North Carolina Sustainable Energy Association (NCSEA) and the North Carolina Clean Energy Business Alliance (NCCEBA) represent most of the solar companies operating in North Carolina. Customers interested in installing solar on their home should feel free to contact Kathleen Fleming of the North Carolina Sustainable Energy Association (NCSEA) at (919) 832-7601 ext. 107 or [kathleen@energync.org](mailto:kathleen@energync.org) to learn more about their options and to be put in touch with local installers.

Fortunately for homeowners, solar installers handle most of the paperwork themselves. Installers are responsible for performing site assessments, obtaining building and electrical permits, handling interconnection applications, and, of course, doing the installation.

**DISCLAIMER: Many of the options available to customers have changing terms and conditions, and some are subject to first-come, first-served availability. Customers interested in pursuing the NC GreenPower option should visit [NC GreenPower's home page](#)<sup>10</sup>. For more details about the Duke Energy Progress SunSense Program, visit the [SunSense Program's home page](#)<sup>11</sup>.**

## Looking Forward

Solar energy has much to offer North Carolina homeowners. With the financial incentives available today, solar is more affordable than ever. This guide should help North Carolinians realize these benefits of solar energy by informing citizens of the options available and what each of these options means for them.

With properly informed citizens, solar can be a step toward saving money for local people, achieving energy independence, and continuing to show that North Carolina is a state at the forefront of modern technology.

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<sup>10</sup> <http://www.ncgreenpower.org/>

<sup>11</sup> <https://www.progress-energy.com/carolinas/home/save-energy-money/energy-efficiency-improvements/sunsense/solar-pv.page>

# **APPENDIX**

**Table 5: Net Metering and NC GreenPower Options Available to DEP Customers**

	Eligibility	Rate Choices	Upfront Rebate	Monthly Capacity Credit	Monthly Production Credit	Monthly Credit Rollover	Time Limits	REC Ownership	Interconnection Fees
<b>NC GreenPower</b>	NC Residents with grid-tied PV systems	RES, R-TOU, R-TOUE, or R-TOUD	None	None	GreenPower credit of \$0.06 per kWh generated, plus avoided cost rate for all kWh generated (CSP-29 tariff)	N/A	GreenPower credit is paid for 5 years only	NC GreenPower owns RECs	\$100 application fee
<b>Net Metering with SunSense</b>	Duke Energy Progress Customers with grid-tied PV systems enrolling before IMW annual limit is fully subscribed	R-TOUD only	\$500 per kW installed (AC rating)	\$4.50 per kW installed (AC rating)	kWh credit on utility bill for excess energy generated	Yes, until May 31 <sup>st</sup> of each year	Capacity credit guaranteed for 5 years only	Utility owns RECs	No fee
<b>Net Metering without SunSense</b>	Duke Energy Progress Customers with grid-tied PV systems	RES, R-TOU, R-TOUE, or R-TOUD	None	None	kWh credit on utility bill for excess energy generated	Yes, until May 31 <sup>st</sup> of each year	No	Utility owns RECs unless customer is using R-TOUD rates	\$100 application fee

Sources: NCGreenPower: Become a Generator (<http://www.ncgreenpower.org/become-a-generator/>) and FAQ (<http://www.ncgreenpower.org/faq/>); Duke Energy Progress: SunSense Solar PV Program ([https://www.progress-energy.com/carolinas/home/save-energy-money/energy-efficiency-improvements/sunsense/solar-pv.page?](https://www.progress-energy.com/carolinas/home/save-energy-money/energy-efficiency-improvements/sunsense/solar-pv.page?;)); Duke Energy Progress: Net Metering (<https://www.progress-energy.com/carolinas/home/renewable-energy/offset/nc-net-meter-toolkit.page>)

**Table 6: Retail Rate Schedule Choices for Duke Energy Progress Customers**

	Available Incentives	Key Features	Basic Customer Charge	Monthly Demand Charge	Monthly Usage Charge	On-Peak Details
<b>Standard Residential Rate Schedule (RES-26)</b>	Net metering or NC GreenPower	Flat rate for all electricity used	\$11.50 per month	None	10.424 cents per kWh (July-Oct.); 9.424 cents per kWh (Nov.-June)	N/A
<b>Residential Time of Use Rate Schedule (R-TOU-26)</b>	Net metering or NC GreenPower	Rate varies based upon time of day and day of week	\$14.60 per month	None	<i>On-peak:</i> 23.943 cents per kWh (June-Sept.); 21.521 cents per kWh (Oct.-May)  <i>Shoulder:</i> 11.834 cents per kWh (June-Sept.); 11.228 cents per kWh (Oct.-May)  <i>Off-Peak:</i> 6.642 cents per kWh	In general: On-peak: 1pm-6pm Mon-Fri (Mar. 31-Sept. 30); 6am-9am Mon-Fri (Mar. 31-Sept. 30)  Shoulder: 11am-1pm and 6pm-8pm Mon-Fri (Sept. 30-Mar. 31); 9am-noon and 5pm-8pm Mon-Fri (Sept. 30-Mar. 31)
<b>Residential Time of Use All-Energy Rate Schedule (R-TOUE-26)</b>	Net metering or NC GreenPower	Rate varies based upon time of day and day of week	\$14.60 per month	None	<i>On-peak:</i> 16.92 cents per kWh (June-Sept.); 16.012 cents per kWh (Oct.-May)  <i>Off-peak:</i> 5.351 cents per kWh	In general: 10am-9pm Mon-Fri (Mar. 31-Sept. 30); 6am-1pm, 4pm-9pm Mon-Fri (Sept.30-Mar.31)
<b>Residential Time-of-Use Demand Rate Schedule (R-TOUD-26)</b>	Net metering with SunSense, net metering, or NC Green-Power	Rate varies based upon time of day and day of the week	\$14.60 per month	\$5.14 per kW (June-Sept.); \$3.81/kW (Oct.-May) for highest demand reached during on-peak hours	<i>On-peak:</i> 6.758 cents per kWh  <i>Off-peak:</i> 5.351 cents per kWh	In general: 10am-9pm Mon-Fri (Mar. 31-Sept. 30);  6am-1pm, 4pm-9pm Mon-Fri (Sept.30-Mar.31)

Sources: Duke Energy Progress RES-26 Tariff (<http://www.duke-energy.com/pdfs/R1-NC-Schedule-RES-dep.pdf>); Duke Energy Progress R-TOU-26 Tariff (<http://www.duke-energy.com/pdfs/R4-NC-Schedule-R-TOU-dep.pdf>); Duke Energy Progress R-TOUE-26 Tariff (<http://www.duke-energy.com/pdfs/R3-NC-Schedule-R-TOUE-dep.pdf>); Duke Energy Progress R-TOUD-26 Tariff (<http://www.duke-energy.com/pdfs/R2-NC-Schedule-R-TOUD-dep.pdf>)

## Model Assumptions and Data Sources:

### Assumptions

- Savings are based upon the assumption that the customer was previously on the RES rate schedule. Savings are thus in relation to what the customer would be paying under the RES tariff with no PV system, all else equal.
- Energy use (kWh) and monthly peak demand (kW) include monthly variation, but no annual variation. Future household energy use may decrease due to greater efficiency, or may increase due to new loads. As it is therefore uncertain in which direction energy use will move, constant usage and demand are assumed.
- A 4 kW DC (3.2 kW AC) PV system is assumed.
- A 0.5% annual PV output degradation rate is assumed and incorporated as a 0.04167% monthly degradation rate in the model. This is the median degradation rate and is taken from NREL's report, "Photovoltaic Degradation Rates- An Annual Review" (<http://www.nrel.gov/docs/fy12osti/51664.pdf>)
- A 2% annual power cost escalator is assumed for per kWh rates, demand charges, basic customer charges, and Cogeneration and Small Power Producer (CSP) seller charge. No cost escalation is assumed for rates under CSP schedule, as these are representative of avoided cost. No escalation is assumed for the REPs rider.
- It is assumed that the cost of the PV system was paid with cash upfront (no financing) or with a 0% interest loan.
- A 31% energy export rate is assumed.
- No discount rate is assumed in the model.
- The assumed PV system life is 25 years.

### Data

- Rates: All electric rate data comes from Duke Energy Progress' tariffs (see <http://www.duke-energy.com/rates/progress-north-carolina.asp>). Tariffs used in this analysis are RES, R-TOU, R-TOUD, R-TOUE, NM, and CSP.
- Energy usage data comes from NREL's dataset, "Commercial and Residential Hourly Load Profiles for all TMY3 Locations in the United States" (<http://en.openei.org/datasets/node/961>). Figures represent estimated average household hourly load. Usage data is adjusted for daylight savings time and categorized as on- and off-peak according to the 2014 calendar year.
- Peak monthly energy demand data is derived from the NREL dataset, "Commercial and Residential Hourly Load Profiles for all TMY3 Locations in the United States" (<http://en.openei.org/datasets/node/961>) and NREL's PVWatts data (<http://pvwatts.nrel.gov/>). Hourly PV output is subtracted from hourly energy demand to determine the effect of a PV system on peak demand. The maximum hourly demand, after PV output has been subtracted, each month is then multiplied by 3 to reflect the difference between average demand of a group and individual household demand, which is likely to be more peaky and variable. As we are looking to identify the very highest 15-minute demand for an individual household, we used this technique. This methodology is based upon the section on demand for electric power in the book *Distributed Power Generation: Planning and Evaluation*, edited by H. Lee Willis (p. 51). (Available at [http://books.google.com/books?id=3T3hV3057oEC&pg=PA51&lpg=PA51&ots=zneeXVUNtx&focus=viewport&dq=residential+peak+load+diversity+factor&output=html\\_text](http://books.google.com/books?id=3T3hV3057oEC&pg=PA51&lpg=PA51&ots=zneeXVUNtx&focus=viewport&dq=residential+peak+load+diversity+factor&output=html_text))
- Solar PV hourly and monthly output data comes from NREL's PVWatts model (<http://pvwatts.nrel.gov/>). Output data is adjusted for daylight savings time. Hourly data is categorized as on- and off-peak according to the 2014 calendar year.
- Low PV system cost (\$3.50/watt) is based upon conversations with local solar installers. High PV system cost (\$5.70/watt) is based upon state-specific average residential PV installation cost data included in Lawrence Berkeley National Laboratory's *Tracking the Sun VI* report: : <http://emp.lbl.gov/sites/all/files/lbnl-6350e.pdf>. This is 2012 data, and used as the high scenario because costs have declined since this report. Medium PV system cost (\$4.60/watt) is halfway between low and high cost scenarios.