UNC
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Residential Electricity Rates and Pricing in North Carolina 2011

Draft

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About the Environmental Finance Center at the University of North Carolina, Chapel Hill

The Environmental Finance Center is an applied research and public service organization housed within the School of Government at the University of North Carolina at Chapel Hill. The EFC partners with organizations across the United States to advise communities, provide training, carry out policy analyses, and disseminate tools and research on a variety of environmental topics.

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This research is based on the interpretation of utility rate sheets obtained in June of 2011. Rates changes and interpreting rate sheets can be challenging, please contact Casey Wichman (wichman@sog.unc.edu) if there are any apparent errors or omissions in this study.

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1. INTRODUCTION

This report provides a comprehensive comparative review of how utilities in North Carolina price electricity for residential customers. This report summarizes rates, rate structures, and provides a graphical analysis of rate setting practices. The primary source of data for this report was rate sheets provided by 96 of the state's 110 residential electricity providers. Financial operations data for municipal electric providers was obtained through the North Carolina Treasurer's Local Government Commission (LGC) audit report for fiscal year 2009-2010. Aggregate summary statistics were obtained from the Energy Information Agency's (EIA) 2009 Residential Energy Consumption Survey (RECS).

There are three distinct types of electricity providers included in this analysis: municipal utilities, cooperative utilities, and investor-owned utilities.

Municipal utilities fall under the NC Public Power umbrella organization and, for the most part, utilize the services of ElectriCities for training, assistance, communications, government affairs, and legal services. Thirty-two municipal providers are members of the North Carolina Eastern Municipal Power Agency (NCEMPA). The NCEMPA is governed by a Board of Directors that owns a portion of five electricity generating plants, operated by investor-owned utility Progress Energy Carolinas, across the state.[1] Nineteen municipal providers are members of the North Carolina Municipal Power Agency Number 1 (NCMPA1). The NCMPA1 is also governed by a Board of Directors, and it owns a portion of the Catawba Nuclear Station, operated by investor-owned utility Duke Energy.[2] Most municipal providers have power purchase agreements with the investor-owned utilities and serve primarily as a distributor of electricity to their customers. As shown in Table 1, municipal providers account for 10% of total electric sales and provide service to 492,000 residential customers (accounts) in North Carolina. The average retail price of electricity for all municipal customers is just over 12 cents per kilowatt-hour.

Electric cooperatives, which are private, independent, and non-for-profit entities, provide service to rural areas in North Carolina. Cooperatives are owned by their members who elect board members. The majority of the cooperatives are themselves members of Touchstone Energy, a national organization that manages electricity distribution and owns portions of electricity generating plants. Electric cooperatives in North Carolina also have purchase agreements with the two investor-owned utilities. As shown in Table 1, electric cooperatives

[1] North Carolina Eastern Municipal Power Agency (NCEMPA) Fact Sheet. http://www.ncpublicpower.com/Libraries/Documents/EA_Fact_Sheet_2009.sflb.ashx (Last accessed: 7/26/11).
[2] North Carolina Eastern Municipal Power Agency Number 1 (NCMPA1) Fact Sheet. http://www.ncpublicpower.com/Libraries/Documents/A1_Fact_Sheet_2009.sflb.ashx (Last accessed: 7/26/11).

account for 22.3% of total electric sales and provide service to roughly 916,000 customers. The average retail price of electricity for all cooperative customers is just under 12 cents per kilowatt-hour.

Table 1- Residential electricity sales summary for providers in North Carolina

Institutional Structure	Total Number of Customers*	Total Sales (megawatt hours)	Total Revenue (thousand dollars)	Average Retail Price ($/kWh)
Municipal	491,576	6,024,377	$691,934	$0.12040
Cooperative	916,884	12,598,933	$1,439,058	$0.11982
Investor-owned	2,767,369	37,687,816	$3,496,161	$0.09573
Totals	**4,175,829**	**56,311,126**	**$5,627,153**	**$0.11953**

* Includes all electricity accounts

Source: EIA Residential Energy Consumption Survey (2009)

Lastly, **investor-owned utilities**, which are large, private companies, provide the bulk of electric service to North Carolina customers. Investor-owned utilities individually own and manage electricity generation plants and provide retail service to their customers, as well as wholesale service to other electricity providers in the state. Investor-owned utilities are regulated by the North Carolina Utilities Commission. As shown in Table 1, investor-owned utilities account for 67% of the total electric sales and provide service to roughly 2,767,000 customers throughout North Carolina. The average retail price for all investor-owned customers is approximately 9.6 cents per kilowatt-hour. Figure 1 shows a map of electricity service territories in North Carolina.

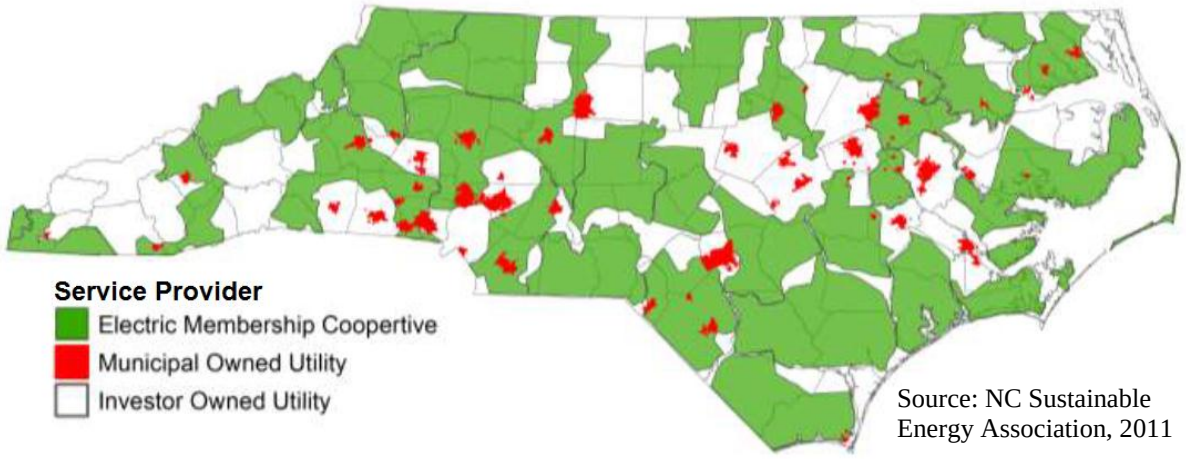

Figure 1- Map of North Carolina Electric Service Providers [3]

[3] Source: "2011 North Carolina Clean Energy Data Book." NC Sustainable Energy Association, June 2011.

This report only addresses residential electricity pricing. Individual utilities rely on a few to over a dozen different rate schedules/structures for various types of customers depending on their rate setting objectives and the needs of their customer base. Rates and rate structures for commercial and industrial customers vary greatly across different levels of energy demand and were not included in this analysis. Different types of residential rates offered by electric utilities are presented in Table 2. The first column counts baseline residential service. The basic service is the most common and easily comparable across utilities. Most of the analysis that follows focuses on these 96 rate structures.

Table 2- Alternative rate structures offered by residential electricity providers

Institutional Structure	Baseline residential electricity service	+	All-electric rates	Electric water heater rates	Time-of-use rates	Hardship/ senior rates	Conser-vation rates
Municipal	67		21	12	7	4	4
Cooperative	26		6	0	6	0	2
Investor-owned	3		1	1	3	0	1
Total Number of Utilities	**96**		**28**	**13**	**16**	**4**	**7**

Source: Utility rate sheets

Additional rate structures available to residential customers are also presented in subsequent columns in Table 2. The second-most prevalent schedule is service for all-electric households. Other utilities provide different rate structures for households with electric-water heaters, time-of-use rates, economic hardship and senior rates, and conservation rates to incentivize the adoption of energy efficient appliances.

Electric utilities employ a range of rate structures to determine what their customers pay. All utilities in North Carolina use a combination of a base service fee and a variable charge in their rate structures. Across all utilities, there is considerable variation in how a customer's bill is calculated. This section outlines the differences in rate structures for residential electricity consumption in North Carolina.

2. CURRENT RATE STRUCTURE DESIGN

Electric utilities employ a range of rate structures to determine what their customers pay. All utilities in North Carolina use a combination of a base service fee and a variable charge in their rate structures. Across all utilities, there is considerable variation in how a customer's bill is calculated. This section outlines the differences in rate structures for residential electricity consumption in North Carolina.

2.1 BASE SERVICE CHARGE

Electric utility expenses are comprised of fixed (salaries, operations) and variable (power purchases, maintenance) costs. Base service charges do not vary from month to month, regardless of consumption, and as such, contribute to a utility's revenue stability. As presented in Table 3, base service charges for North Carolina electricity providers are designed in several ways including: (1) a constant base charge for all residential customers, (2) a base charge that varies by phase (i.e. single-phase or triple-phase) service, and (3) a base charge that includes a predetermined level of consumption.

Table 3- Base service charge structures

Institutional Structure	Utilities with constant base charge	Utilities with base charge varying by phase	Utilities with base charges that include predetermined level of consumption
Municipal	55	11	1
Cooperative	13	12	1
Investor-owned	2	1	0
Totals	**70**	**24**	**2**

Source: Utility rate sheets

As shown in Table 3, 16.4% of municipal providers, 46.2% of cooperatives and 33.3% of investor-owned utilities had variable base charges. Of those, one municipal provider and one electric cooperative also included a small amount of electricity (74 and 20 kWh/month, respectively) in the base service charge. No base service charges for the utilities in this report varied seasonally. 25% of all utilities have base charge structures that vary by phase. Three-phase power service differs from single-phase alternate current in that it delivers three staggered single-phase current such that the power delivered to the load is the same at any instant. The nature of three-phase service makes it optimal for commercial and industrial uses.

2.2 SEASONAL RATE STRUCTURES

Electricity usage is linked to patterns in weather and climate, and high usage during part of the year lead to higher costs for utilities as they are forced as bring on more expensive production facilities. Throughout the year, residential electricity use displays two trends for residential customers in North Carolina: a winter peak, induced by the energy required by households to heat their homes, and a slightly higher summer peak, induced by the energy required by air conditioning units. Due to the higher demand in the summer, some utilities implement higher summer rates to jointly induce conservation and capture revenue to cover the cost of the increased load.

Table 4- Utilities with seasonal rate structures

Institutional Structure	Total Number of Utilities	Number of Utilities with Seasonal Rates	Number of Customers Who Face Seasonal Rates	Average Ratio of Summer/Winter Bill at 1,000 kWh/month	Most Prevalent Start Month for Summer Rates	Most Prevalent Start Month for Winter Rates
Municipal	67	18	181,627	1.059	June	October
Cooperative	26	15	434,890	1.042	May	November
Investor-owned	3	3	2,767,369	1.112	July	November
Totals	**96**	**36**	**3,383,886**	**1.045**	**June**	**November**

Source: Utility rate sheets, EIA Residential Energy Consumption Survey (2009)

As shown in Table 6, 38% of all utilities have seasonal rates for residential customers in North Carolina. Only 27% of municipal utilities have seasonal rates, while 58% of cooperatives and all of the investor-owned utilities have seasonal rates. For municipal providers with seasonal rates, the typical "warm season" spans from June to October, while the typical "warm season" for cooperatives is from May to November. Investor-owned utilities display a typical "warm season" spanning from July to October.

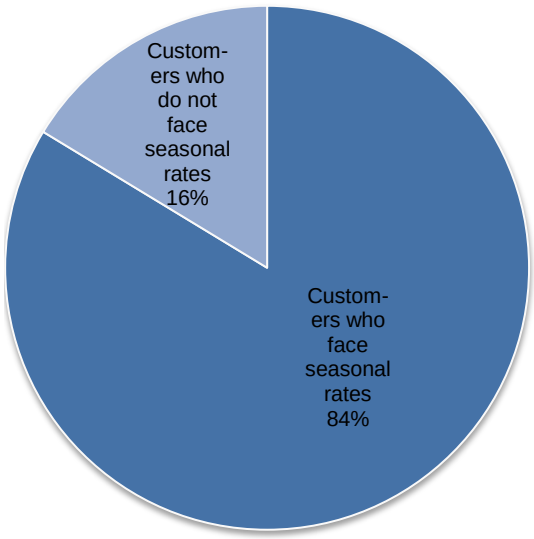

Figure 2- Percentages of customers who face seasonal rates

In contrast to the percentage of utilities that have seasonal rates, 3,383,886 of residential electricity customers, comprising 84% of the total customers in North Carolina, face seasonal rates. This is result driven by the investor-owned utilities with large service populations relative to the other utilities. The average ratio of summer bills to winter bills (estimated at a consumption level of 1,000 kWh/month) is 1.059, 1.042, and 1.112 for municipalities, cooperatives, and investor-owned utilities respectively.

2.3 CONSUMPTION RATE STRUCTURES

Rate structures for electricity consumption in North Carolina fall in one of four categories: uniform rate, increasing block, decreasing block, or increasing/decreasing block structures. In a uniform rate structure, all kilowatt-hours consumed are charged at the same marginal rate. In an increasing block structure, the marginal rate per kilowatt-hour increases at certain quantities of electricity consumed. This structure is often employed by utilities that want to encourage conservation. In a decreasing block structure, the marginal rate per kilowatt-hour decreases at certain quantities of electricity consumed. This structure might be used to promote economic development or to reflect that it might cost less to service large users. Lastly, an increasing/decreasing block structure is a hybrid between increasing and decreasing block rates. In this structure, the marginal rate per kilowatt-hour might increase from the first to the second block of consumption and decrease from the second to the third block of consumption. For utilities with block rates, the average number of blocks is three.

Table 5- Consumption rate structures for utilities without seasonal rates

*Utilities **without** seasonal rates*					
Institutional Structure	**Utilities with uniform rates**	**Utilities with increasing block rates**	**Utilities with decreasing block rates**	**Utilities with inc/dec block rates**	**Totals**
Municipal	25	5	15	4	**49**
Cooperative	8	1	2	0	**11**
Investor-owned	0	0	0	0	**0**
Totals	**33**	**6**	**17**	**4**	**60**

Source: Utility rate sheets

For electricity providers in North Carolina without seasonal rates, uniform rate structures are the most prevalent, at 55% of all rate structures. The second most common rate structure is decreasing block structures comprising 28% of all structures without seasonal rates. This is driven by the large number of municipal providers who employ decreasing block structures.

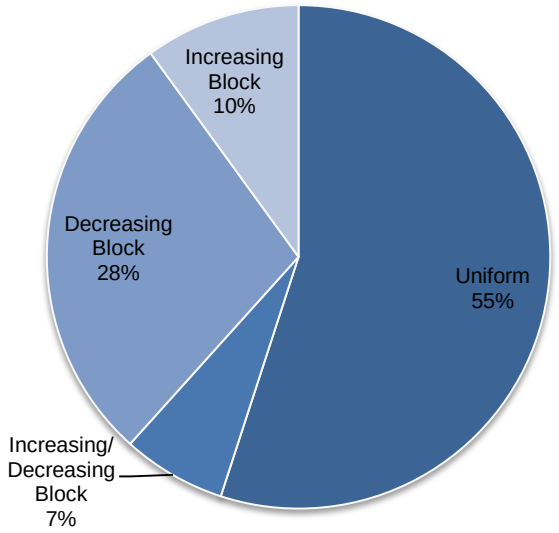

Figure 3- Percentages of consumption rate structures for utilities without seasonal rates

Table 6- Consumption rate structures for utilities with seasonal rates

		*Utilities **with** seasonal rates*				
	Institutional Structure	**Utilities with uniform rates**	**Utilities with increasing block rates**	**Utilities with decreasing block rates**	**Utilities with inc/dec block rates**	**Totals**
Warm Season	**Municipal**	9	3	4	2	**18**
	Cooperative	10	1	4	0	**15**
	Investor-owned	3	0	0	0	**3**
	Totals	**22**	**4**	**8**	**2**	**36**
Cool Season	**Municipal**	7	2	7	2	**18**
	Cooperative	5	0	10	0	**15**
	Investor-owned	3	0	0	0	**3**
	Totals	**15**	**2**	**17**	**2**	**36**

Source: Utility rate sheets

Consumption rate structures for electricity providers in North Carolina with seasonal rates are presented in Table 5 and Figure 3. In the warm season, uniform rates are most common, at 61%, and decreasing block rates are second most common, at 22%. Surprisingly, only 11% of utilities have increasing block rates in the summer, when peak demand is at its highest. In the cool season, decreasing block rates are most prevalent, at 47%, and uniform rates are second most common, at 42%. The proportion of utilities that have increasing block rates decreases to 5% in the cool season. This trend in decreasing block rates between seasons is striking because aggregate household electricity use in the winter, largely driven by heating systems and shortened daylight hours, contributes heavily to a utility's load.

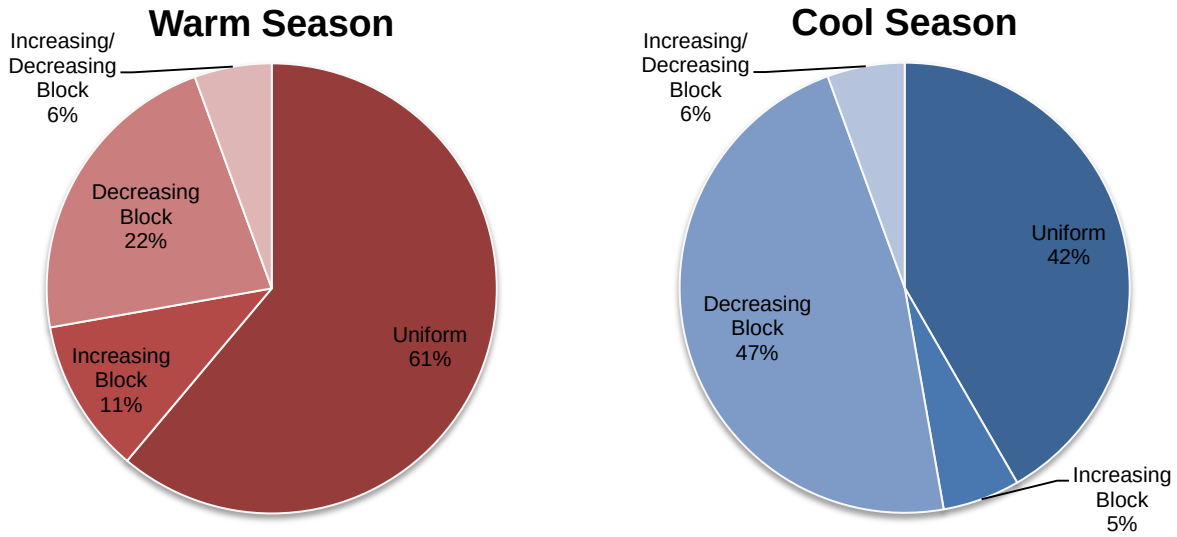

Figure 4- Percentages of consumption rate structures for utilities with seasonal

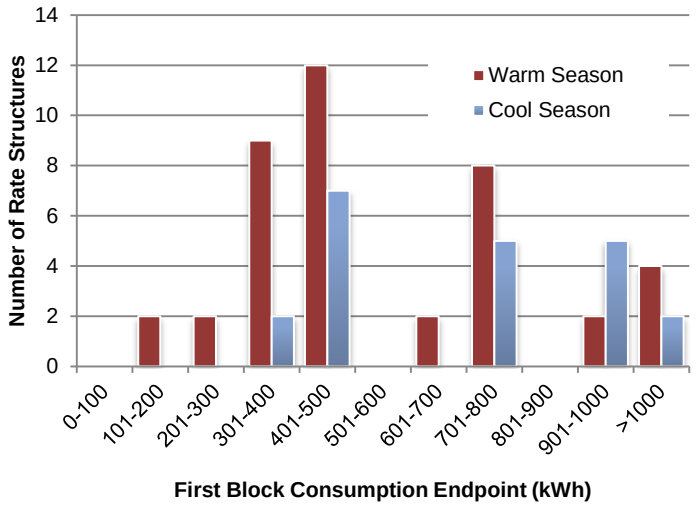

Figure 5- First block consumption endpoint for utilities with block rate structures

Figure 4 presents the endpoint for the first block of consumption endpoint for NC utilities with blocked seasonal rates. In both the warm and cool seasons, the most common consumption endpoint is between 401 and 500 kilowatt-hours per month, with few first block endpoints beyond 1,000 kilowatt-hours per month. Average monthly residential consumption in North Carolina is 1,124 kilowatt-hours per month, so it is likely that the block rate structures affect a large proportion of residential customers who face these rates.[4]

2.4 ENERGY DEMAND RATE STRUCTURES

In addition to base service charges and consumption charges, some utilities charge customers based on their contribution to the utility's peak demand. This energy demand charge is common in rate structures for commercial and industrial customers, although two utilities in this analysis—one municipal provider and one electric cooperative—displayed energy demand charges for residential customers as well. This rate is determined by a customer's maximum demand, in an allotted time-interval, each month. The two utilities charge:

- $4.19 for every kilowatt demanded over 10 kilowatts in a 30-minute time period, and
- $2.30 for every kilowatt demanded over 30 kilowatts in a 30-minute time period.

For example, a household with service from the first utility that uses 2,000 kWh of electricity a month and peaks at 15 kW of use for a 30-minute time frame on a particular day would be charged the marginal price for each of the 2,000 kWh consumed PLUS $4.19 per kilowatt for the five kilowatts demanded beyond the 10 kW allowance.

[4] Source: EIA Residential Energy Consumption Survey, 2009.

2.5 RIDERS ON RESIDENTIAL BILLS

Table 7- Riders available to residential customers

Institutional Structure	Wholesale Cost of Power Adjustment	NC GreenPower	Renewable Energy Generation	Renewable Energy Portfolio Standard	Curtailable Service Adjustment	Utilities with No Riders
Municipal	13	2	1	12	1	45
Cooperative	19	6	6	10	3	6
Investor-owned	3	2	2	1	0	0
Total Number of Riders	**35**	**10**	**9**	**23**	**4**	**51**

Source: Utility rate sheets

In addition to charges for electricity service, many electricity utilities provide different riders, or a variety of mandatory and voluntary charges in addition to service charges, on customers' bills. The most common residential rider for electric utilities in North Carolina, as presented in Table 7, is a wholesale power cost adjustment to account for any transmission costs in providing the customer with electricity. The next most common rider is the renewable energy portfolio standard which provides funds to accommodate the REPS mandate requiring a percentage of electricity to be generated by renewable and/or energy efficiency programs. NC GreenPower, renewable energy generation credits, and curtailable service adjustments are available for a small proportion of utilities in North Carolina. Further, it is possible that utilities do not have an entire list of riders included on the rate sheets used for this analysis. Table 3, then, displays the minimum number of utilities with these riders available.

3. CURRENT RESIDENTIAL ELECTRICITY RATES

While the preceding discussion of rate structures has important implications for utility management, revenue stability, and conservation, it provides little information about what residential customers are actually paying for electricity service. This section outlines and analyzes the charges for electricity that North Carolinians face.

3.1 BASE SERVICE CHARGES

As mentioned previously, base service charges are important to utilities as they contribute to revenue stability, though high base charges make it more difficult for a utility to provide their customers with financial incentives to curtail usage. The median and mean base charges for different service populations of utilities are presented in Table 8. As shown, base service charges rarely change from season to season, though there seems to be variation in base charges across different sizes of utilities. In all cases, the mean exceeds the median charge, which indicates that the distribution of base fees is skewed towards high charge.

Table 8- Seasonal base service charge statistics based on service population of utility

	Warm Season Base Charges			Cool Season Base Charges		
Size of Utility (Service Population)	**Total Number of Structures**	**Median Base Charge**	**Mean Base Charge**	**Total Number of Structures**	**Median Base Charge**	**Mean Base Charge**
1 – 1,000	11	$10.22	$11.40	11	$10.22	$11.40
1,001 – 2,500	23	$9.72	$9.91	23	$9.72	$9.91
2,501 – 5,000	10	$9.25	$9.34	10	$9.25	$9.34
5,001 – 10,000	10	$10.56	$11.84	10	$10.56	$11.84
10,001 – 50,000	31	$15.00	$15.43	31	$15.00	$15.43
50,000+	11	$10.80	$14.23	11	$14.00	$15.43
All Rate Structures	***96***	***$10.41***	***$12.50***	***96***	***$10.42***	***$11.40***

Source: Utility rate sheets

The distribution of base service charges for all utilities is plotted in Figure 6. The most common monthly charge is between $5 and $10, while a handful of utilities have base service charges that exceed $20 per month.

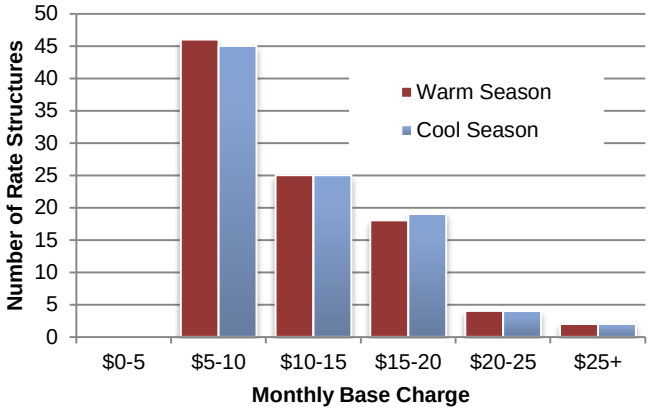

Figure 6- Monthly base service charge for residential customers

3.2 MARGINAL RATES PER KILOWATT-HOUR

The distribution of electricity rates per kilowatt-hour is presented in Figure 7. The figure shows the charge for the next kilowatt-hour beyond 1,000 kilowatt-hours per month for all utilities. In the cool season, the most common marginal rate is between 9 and 10 cents per kilowatt-hour, while the most common marginal rate in the warm season is between 10 and 11 cents per kilowatt-hour. Both distributions have maximum marginal rates between 17 and 18 cents per kilowatt-hour and minimum marginal rates between 5 and 6 cents per kilowatt-hour.

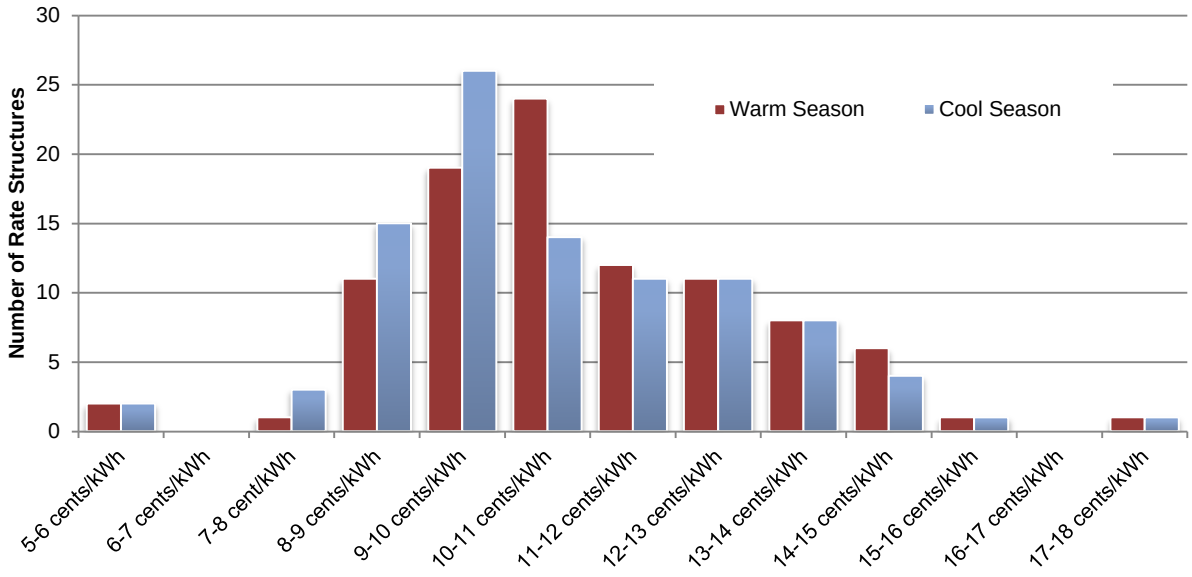

Figure 7- Price for the next kWh of electricity consumed at 1,000 kWh/month

3.3 MONTHLY-EQUIVALENT RESIDENTIAL BILLS

Using utility rate sheets, the EFC developed a model to calculate monthly-equivalent bills for residential customers for a range of electricity consumption amounts. The median bill for all utilities at 1,000; 2,000; and 3,000 kilowatt-hours per month is presented in Table 9.

Table 9- Seasonal monthly-equivalent bills for varying consumption levels

	Warm Season			*Cool Season*		
Institutional Structure	**Median Bill at 1,000 kWh/month**	**Median Bill at 2,000 kWh/month**	**Median Bill at 3,000 kWh/month**	**Median Bill at 1,000 kWh/month**	**Median Bill at 2,000 kWh/month**	**Median Bill at 3,000 kWh/month**
Municipal	$124.42	$233.86	$341.48	$124.09	$233.78	$341.18
Cooperative	$120.35	$224.75	$327.25	$118.98	$214.15	$307.47
Investor-owned	$104.63	$199.43	$294.23	$95.02	$180.82	$266.62
Totals	**$121.65**	**$228.26**	**$333.84**	**$120.19**	**$222.32**	**$321.51**

Source: Utility rate sheets

As shown in Table 9, the median bill for customers of municipal electricity providers and electric cooperatives are not significantly different. The median bill for investor-owned utilities, however, is significantly lower than that of municipal and cooperative utilities. Part of this explanation is likely explained by the economies of scale that are at work–larger investor-owned utilities spread their costs, particularly high fixed costs, over much larger customer bases.

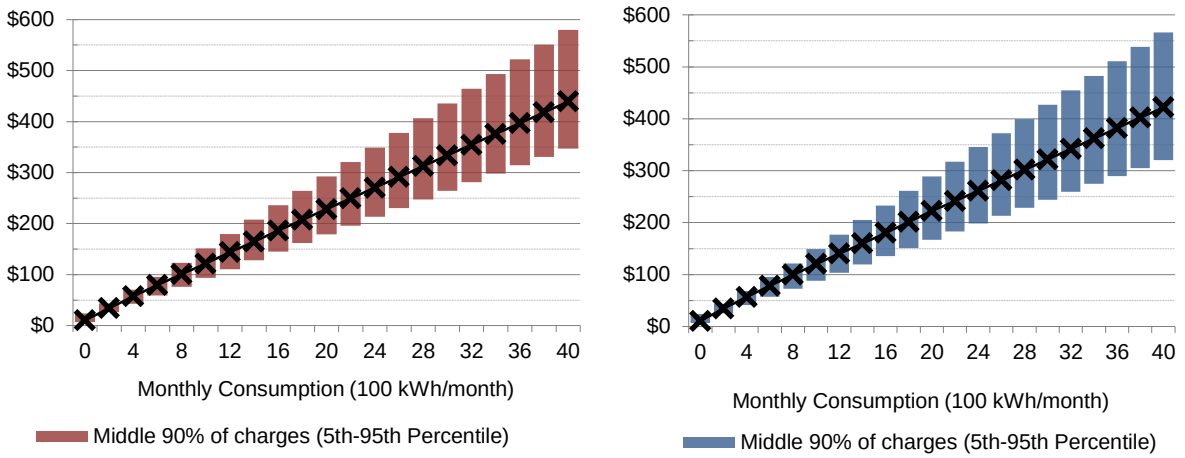

Figure 8- Monthly-equivalent residential electricity bills at varying consumption levels

To further examine the variance of billed amounts to residential customers across utilities, the middle 90% of bills are plotted in Figure 8 for monthly consumption levels ranging from 0 to 4,000 kilowatt-hours per month. While the disparity for extremely high consumption levels is several hundred dollars, even for average consumption around 1,000 kilowatt-hours per month the difference between the 5th-percentile and the 95th-percentile is approximately $50 per month. If a customer in the 5th-percentile and a customer in the 95th-percentile each used 1,000 kilowatt-hours per month, they would have a difference greater than $600 between their total bills after a year of consumption.

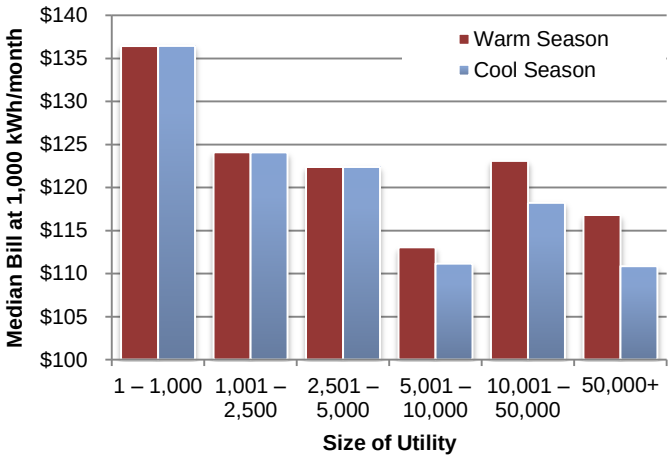

Figure 9- Seasonal monthly-equivalent bill at 1,000 kWh/month by utility service population

Further, the median bill for 1,000 kilowatt-hours per month for utilities of different service populations is presented in Figure 9. There is a significant reduction in the median bill, from over $135 to just about $110, as the utility size increases. Indeed, the smallest utilities have the highest median bill in both warm and cool seasons. Utilities with service populations between 5,001 and 10,000 customers have lowest warm season bills and utilities with service populations beyond 50,000 customers have the lowest cool season bills.

4. THE COST OF ELECTRICITY COMPARED TO HOUSEHOLD INCOME

The tables and figures presented in the previous section outline and analyze what North Carolina residents pay for electricity service depending on the type of utility. This section addresses the relationship between the monthly cost to households and their income at the community level. Since the majority of electricity customers in North Carolina do not have the ability to change electricity providers, they are subjected to the electricity rates in their community.

In order to show the different impacts electricity use has on family expenditures across the state, annual median household incomes for each municipality in North Carolina, obtained from the NC Census, were matched with the service area of each utility. If an investor-owned utility or an electric cooperative's service area spread over multiple counties, a population-weighted average of the median household income was calculated and assigned to that utility.

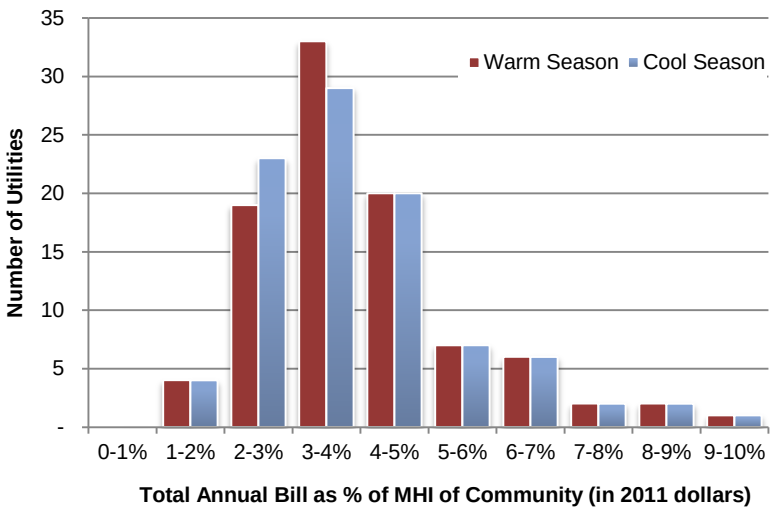

Figure 10- Annual residential electricity bill as a percentage of median household income

For municipal electricity providers, the median household income for each town or city was used. Then, annual-equivalent bills at 1,000 kilowatt-hours per month were divided by median household income for each municipality. Total annual cost of electric service as a percentage of median household income across the different utility service areas is presented in Figure 10. The majority of utilities have a customer base were the average annual bills fall between 2% and 5% of annual income. An important feature of Figure 10 is that it depicts over 15 electricity service providers that have annual equivalent bills at 1,000 kilowatt-hours per month between 5% and 10% of median household income for their service population.

5. FINANCIAL SUSTAINABILITY

When analyzing residential electricity rates, it is important to consider the supply-side factors that influence a utility's rate-setting practices. The price of electricity, paid by the customer, should reflect the utility's cost of providing that electricity.

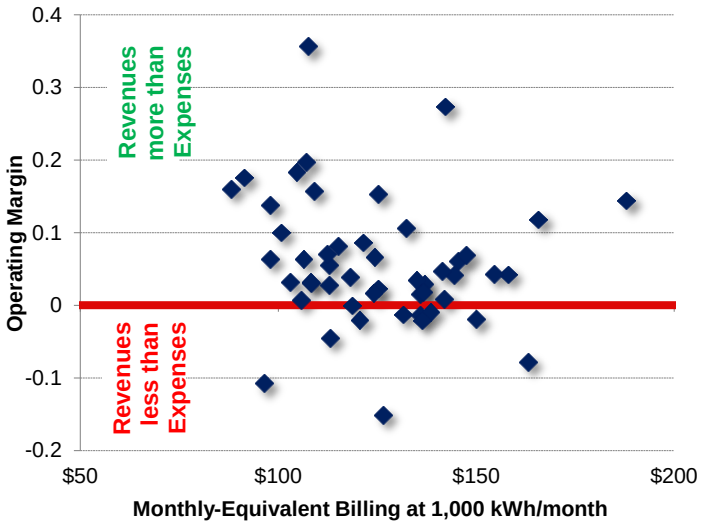

Figure 11- Combined monthly-equivalent residential bill for municipal utilities with reported LGC data on operating margins (FY 2010)

In assessing the cost side of operations for a utility, operating margins were acquired for municipal utilities through the audited financial reports of the North Carolina Treasurer. Municipal utility operating revenues is plotted against the monthly-equivalent residential bill for 1,000 kilowatt-hours per month for each municipal utility with available data.[5] There is no apparent relationship in Figure 11, though it is informative to note that approximately one-third of the municipalities have operating margins below zero. This statistic indicates that there are numerous municipal utilities that have costs exceeding revenues.

Additionally, data on the percent of total operating revenue were examined to further explore the relationship between operating expenses and charges to residential customers. In Figure 12, median operating margin and median monthly-equivalent bill at 1,000 kilowatt-hours per month are plotted for different percentages of power purchase percentages. Figure 12 indicates that utilities with low power purchase, relative to their revenue, have the highest operating margins and lowest median bills.

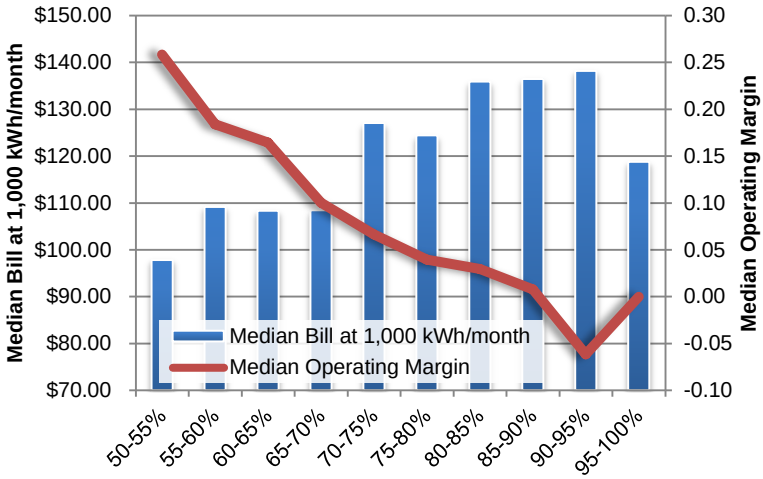

Figure 12- Median bill at 1,000 kWh/month and median operating margin by power purchases (as a percentage of total operating revenue) for municipal utilities

[5] Operating margin is defined as [Operating Revenue – Operating Costs]/Operating Revenue