responses are listed by state below; most of these comments have to do with rates and billing, particularly in South Carolina.

**North Carolina (N=10)**

- *I know they're working diligently to get people's power back on. Duke Energy needs to have numbers to call for a status updates to find out if your power is back on or not when you're away from home.*
- *I've had some difficulties with power being restored to one of my houses I recently renovated for a new tenant. The power was not turned on at the time I indicated it needed to be and it caused problems as far as being able to finish the project and getting the place ready for the new tenant to move in by the time I had earlier indicated. Somebody at Duke dropped the ball on this and I'm not happy about it.*
- *It's one of those days I need them and I wish I didn't. Meter reading should be done by a person getting out of their vehicle and coming to physically read it, not driving by with a scanner and a computer. If somebody protests something, they don't say anything. They don't care about the community; all they care about is control. Duke Energy is just a little too big for their britches.*
- *Like with the coal ash problem, Duke Energy needs to stop making excuses about that pollution and just clean it up. Also, the customer service needs to be better. Whenever I have an issue with my electricity it always takes them forever to help me get the problem fixed.*
- *Since November, I haven't been getting any kilowatt hours on my bill and I had to call in and let them know of their mistake. My bill was wrong and they weren't trying to rectify it. I called it this month and hopefully it will be fixed.*
- *Once, I went to pay the bill and I was $1 or something short and very close to having the power cut off, but they want it all. I'm mean, they could cut a break. Not everybody can come up with all that money.*
- *They don't give senior citizens like me a break. If you're late on your bill, they just cut you off. You could be a little more lenient with people over 50. I don't get much assistance, no Medicare, I get food stamps. I only have a part-time job. If you're on a fixed income, you need a little break.*
- *My bill's been really high. I haven't been using my heat too high. Each room has its own thermostat with no numbers.*
- *The rates are too high.*
- *They should lower their rates.*

**South Carolina (N=9)**

- *Duke could perform better maintenance on power lines and electrical boxes.*
- *My energy bills are still very high even though I'm doing things to not consume excess energy.*
- *The cost of my utilities has gone way, way up and I am not doing anything different as far as using energy. Ever since that new meter was installed my utility costs are out of hand*

*high. Last month my bill was $298! I know that I'm not using that much power, I'm using the same amount I always have, but it costs much more.*

- *It doesn't really matter how energy-efficient you are, you're still going to pay their high rates, while they post record profits.*
- *They have a monopoly in our area. The last rate increase that we got, it just wasn't necessary. Energy is something you have to have, you just have to suck it up. Don't increase the rates.*
- *The cost of the Kilowatt hour has gotten quite high, I'd like to see the cost go down for our utilities.*
- *My bill has been so high.*
- *The rates are too high. It's been hard these last three months.*
- *We could be notified ahead of time of large increases in rates.*

Table 114 indicates that 60.0% (48 out of 80) of surveyed non-participants felt more positive about Duke Energy based on what they know about the Residential Neighborhood program, including 20.0% (16 out of 80) who said they felt "much more positive" toward Duke Energy. Only 6.3% (5 out of 80) non-participants said the program made them feel more negative towards Duke Energy, while 32.5% (26 out of 80) said they felt about the same. There are no statistically significant differences between North and South Carolina customers.

**Table 114. Changes in Non-Participants' Attitude toward Duke Energy Based on Knowledge of the Residential Neighborhoods Program**

| Base: non-participants who are aware of the program | North Carolina (N=31) | South Carolina (N=49) | Total (N=80) |
|---|---|---|---|
| Much more positive toward Duke Energy | 12.9% | 24.5% | 20.0% |
| Somewhat more positive | 41.9% | 38.8% | 40.0% |
| About the same | 35.5% | 30.6% | 32.5% |
| Somewhat more negative | 6.5% | 2.0% | 3.8% |
| Much more negative | 0.0% | 4.1% | 2.5% |
| Don't know / not specified | 3.2% | 0.0% | 1.3% |

Non-participants who said they felt more positive or more negative towards Duke Energy based on what they know about the Residential Neighborhoods program were asked why they felt more positive or more negative. These responses are listed and categorized below; as indicated above in Table 114, there are about ten times as many "more positive" comments as there are "more negative" comments.

**Much more positive (N=16)**

- *Anyway they can help you save on your energy bill is good.*
- *Because in most states I've been in, I've never seen any other companies offer any sort of programs like this. It's great how Duke Energy is making efforts towards saving energy for their business and for their customers. Anything that saves money is good in my opinion.*

- *Because when talking about your energy company, sometimes you feel out of control, like you as the individual customer have no say or impact towards improving the energy situation. I like that Duke is trying to help out their customers on an individual basis.*
- *I appreciate that Duke is trying to help their customers save energy.*
- *I got the help I needed.*
- *I grew up with Duke Energy. I like it that Duke Energy provides you with some leeway. If you don't have enough money to make your electric bill that month, they work with you; I tip my hat to them because most energy companies don't let you do that.*
- *I see that Duke Energy wants to help me save money on my energy bills with these programs, and that is a plus.*
- *I think is good that they're willing to go out in the community to help people, to take the initiative to do this. This program makes me feel much more positive about them. The only problem I have with them is that they gave the guy who rented my house before my phone number by accident and he kept calling me for a refund that Duke was supposed to mail to him. They probably just read off a list of numbers associated with my address, but he knew I lived in this house, so he wrote down the one he knew wasn't his. He also would come by and check my mail when I wasn't home. I tried to complain, but I pay online, so it was too hard to do. I had to change my number because of this, so that's the only reason I gave them a nine instead of a ten.*
- *I think that any assistance is beneficial and results in positive opinions about the company. Anything offered to help with energy costs helps with our feeling towards Duke.*
- *It is great thing you are doing to help us folks out.*
- *It seems like Duke Energy was trying to help us out with our utility charges which is great. Also, by contacting each of us individually it makes us feel important, like our participation and opinions are important to Duke; it's good to be considered individually.*
- *It sounds like Duke is really trying to help folks out with their houses and their power bills. Also because, if we have a power outage, it doesn't take forever to get the power back on. I think Duke is doing a great job.*
- *Just for Duke Energy to offer services like free light bulbs and someone coming to your house to check your efficiency is a big step on their part; they didn't have to do that.*
- *My attitude would be even better if they come to my house again with this program.*
- *That's a lot of good ideas for things. You get a surprise like this winter and it really opens your eyes. This program sounds very good.*
- *They took the initiative to reach out to the neighborhood and the residents to help out with the cost of the bills. Some type of assistance was a good thing.*

**Somewhat more positive (N=32)**

- *Anything that is going to help folks out is a good thing.*
- *Duke Energy works with people and understands when people have high bills they can't pay. I would like it if this program came around again. I'd like to consider it, but the timing has to be right, not spring or summer.*

- *I am glad that they are trying to do something about energy use.*
- *I can see how these programs are helping people so I think those are good efforts on Duke Energy's part.*
- *I like the free bulbs that Duke sent me. If they didn't give them to me I wouldn't be using them on my own.*
- *I mean, I like Duke Energy, I think they do a good job. I think these programs they offer really can help a lot of people.*
- *I really don't know if those improvements given in the program really work because I did not do the program. It sounds good though.*
- *I think it's good that they're helping customers get their bill in line.*
- *I think this is a very good thing that they do for people.*
- *I thought it was real nice from what I'd seen, but I thought you couldn't do it if you didn't own your home.*
- *I'm glad to see that they are trying to help people out and I think their efforts to save energy help the environment.*
- *I'm only feeling somewhat more positive about Duke because their rates are too high. I like that they have these programs to help people with their homes though.*
- *I've never had any problems with Duke Energy and I like that they have these programs to help people out.*
- *I've never had problems with Duke, they have great customer service and with programs like these, it seems like they are concerned for their customers' well-being.*
- *It seems like they are trying to help people save energy; it seems like they do care. Duke Energy has worked with us several times when we were close to having our lights turned off, and I have a CPAP machine that needs to be on, or I'd be dead.*
- *It seems like you guys are making some kind of effort to help us out.*
- *It's positive if they help people.*
- *My light bill is still kind of high. I'm on disability, so I can't afford that much a month.*
- *The offering of the light bulbs through Duke Energy brought my opinion up. We appreciate any help we can get.*
- *Seeing how Duke Energy cares to help us heat our homes and make them more efficient to try to save us money is a good thing.*
- *The gentleman that I talked to was very helpful and my neighbors all did it. I have done a few things and my bill has gone down.*
- *There's always something that you might miss.*
- *They gave me those light bulbs free of charge to help me save energy.*
- *They make you have a better understanding and help you lower your energy bills.*
- *They try to get the customers to conserve energy; that helps us out a little more.*
- *They're coming around helping people save energy and all that. I hope they do it again this summer!*
- *They're trying to help out folks with lower incomes.*

- *This program's a good thing for people who need it. It's a good thing for Duke to bring it to people, but somebody's making money somewhere. They don't do this stuff for nothing. You have to pay to play.*
- *We all need to be helping with saving energy, and I can see with offering this program that Duke is trying to do their part.*
- *What they were trying to do was a great thing. They pay some of the money themselves to get stuff done.*
- *Y'all are trying to help us with our bills. Duke's always going the extra mile, passing out light bulbs and giving help like that.*
- *I don't know.*

**Somewhat more negative (N=3)**

- *My power bill was incorrect, so this has put a damper on things. I think they just do these things, like this program, to make themselves look better in the community. They don't care about the community. They don't listen to us.*
- *The prices are so high and getting higher, even though I'm not using as much.*
- *We're not seeing a change in our power bill versus last year. We've made all these adjustments this past year and haven't seen a change. The power bills have gone up so much, we've had to install solar panels at work.*

**Much more negative (N=2)**

- *Every year they report increased profits, while everyone's bills go up, regardless of income. They don't have many programs for the seniors and the poor. You either pay what they tell you or get your power cut off. It would be nice if they expanded the income requirements for this program.*
- *The program is probably a rip off. I don't like any little programs where some stranger has to come into my home.*

# Appendix A: Counts of Participants for Billing Analysis

| Participant Since YYYYMM | Number of New Participants in Each Month |
|---|---|
| 201303 | 56 |
| 201304 | 100 |
| 201305 | 119 |
| 201306 | 307 |
| 201307 | 124 |
| 201308 | 401 |
| 201309 | 361 |
| 201310 | 302 |
| 201311 | 445 |
| 201312 | 629 |
| 201401 | 463 |
| 201402 | 325 |
| 201403 | 984 |
| 201404 | 1269 |
| 201405 | 912 |
| 201406 | 767 |
| 201407 | 514 |
| 201408 | 69 |

# Appendix B: Estimated Model

This appendix presents the complete model estimated for the billing analysis. The model includes indicators for each month (the YYYYMM variable), temperature, and the participation variables.

Variables:

- Interaction of monthly binary indicator and temperature:
  - 201012 – 201408: Binary indicator variables for that YYYYMM
  - CDD*MonthlyID: product of monthly CDD and binary monthly variables
  - HDD* MonthlyID: product of monthly CDD and binary monthly variables
- Indicator variables for participation in other Duke Energy programs:
  - Free_cfl: Residential Smart $aver Energy Efficiency: CFL
  - CFL_promo: Residential Smart $aver Energy Efficiency: Discounted CFL
  - CFL_special: Residential Energy Efficiency: Specialty Bulbs
  - K12: Energy Education for Schools
  - HEHC: Home Energy House Call
  - lowinc_weath: Low Income Weatherization
  - PER-OHEC: Personalized Energy Report
  - appl_recycle: Appliance Recycling Program
  - insul_seal_date: Residential Smart $aver: Insulation and Seal
  - refrige_replace: Refrigerator replacement program (included in the analysis whereas no participation)
  - furnace_replace: Furnace replacement program (included in the analysis whereas no participation)
  - smsvr_HVAC: Residential Smart $aver HVAC
  - HVAC_tuneup_date: Residential Smart $aver HVAC tune up (included in the analysis whereas no participation)
  - Property_mgr: Residential Smart $aver: Property Manager CFLs
  - MyHER: My Home Energy Report

Number of Observations Read 281382
Number of Observations Used 281382

Dependent Variable: kwhd

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 8250 | 93634249.4 | 11349.6 | 63.97 | <.0001 |
| Error | 273131 | 48455708.6 | 177.4 | | |
| Corrected Total | 281381 | 142089958.0 | | | |

| R-Square | Coeff Var | Root MSE | kwhd Mean |
|---|---|---|---|
| 0.658979 | 40.77580 | 13.31947 | 32.66514 |

| Source | DF | Type I SS | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Account_Id | 8146 | 78311901.75 | 9613.54 | 54.19 | <.0001 |
| cdd*monthID | 45 | 7934142.79 | 176314.28 | 993.83 | <.0001 |
| hdd*monthID | 46 | 7365957.26 | 160129.51 | 902.60 | <.0001 |
| k12_date | 1 | 11.87 | 11.87 | 0.07 | 0.7959 |
| Insul_Seal_date | 1 | 11.42 | 11.42 | 0.06 | 0.7997 |
| Free_CFL | 1 | 1203.14 | 1203.14 | 6.78 | 0.0092 |
| cfl_promo | 1 | 8.23 | 8.23 | 0.05 | 0.8295 |
| cfl_special | 1 | 7.20 | 7.20 | 0.04 | 0.8403 |
| HEHC | 1 | 438.65 | 438.65 | 2.47 | 0.1159 |
| lowinc_weath | 1 | 490.88 | 490.88 | 2.77 | 0.0962 |
| PER_OHEC | 1 | 318.12 | 318.12 | 1.79 | 0.1805 |
| SmSvr_HVAC | 1 | 10.05 | 10.05 | 0.06 | 0.8119 |
| Appl_Recycle | 1 | 6.64 | 6.64 | 0.04 | 0.8466 |
| Property_Mgr | 1 | 2296.47 | 2296.47 | 12.94 | 0.0003 |
| MyHER | 1 | 2512.17 | 2512.17 | 14.16 | 0.0002 |
| part | 1 | 14932.74 | 14932.74 | 84.17 | <.0001 |

| Source | DF | Type III SS | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| cdd*monthID | 45 | 5676757.168 | 126150.159 | 711.07 | <.0001 |
| hdd*monthID | 46 | 7327886.607 | 159301.883 | 897.94 | <.0001 |
| k12_date | 1 | 8.935 | 8.935 | 0.05 | 0.8224 |
| Insul_Seal_date | 1 | 12.771 | 12.771 | 0.07 | 0.7885 |
| Free_CFL | 1 | 1401.022 | 1401.022 | 7.90 | 0.0050 |
| cfl_promo | 1 | 16.448 | 16.448 | 0.09 | 0.7608 |
| Source | DF | Type III SS | Mean Square | F Value | Pr > F |
| cfl_special | 1 | 3.734 | 3.734 | 0.02 | 0.8847 |
| HEHC | 1 | 445.266 | 445.266 | 2.51 | 0.1131 |
| lowinc_weath | 1 | 516.458 | 516.458 | 2.91 | 0.0880 |
| PER_OHEC | 1 | 325.125 | 325.125 | 1.83 | 0.1758 |
| SmSvr_HVAC | 1 | 14.422 | 14.422 | 0.08 | 0.7756 |
| Appl_Recycle | 1 | 4.639 | 4.639 | 0.03 | 0.8715 |
| Property_Mgr | 1 | 2551.777 | 2551.777 | 14.38 | 0.0001 |
| MyHER | 1 | 2159.766 | 2159.766 | 12.17 | 0.0005 |
| part | 1 | 14932.744 | 14932.744 | 84.17 | <.0001 |

| Parameter | | Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| cdd*monthID | 201012 | 0.12242608 B | 1.4813726 | 0.08 | 0.9341 |
| cdd*monthID | 201101 | 0.01047102 B | 0.4774856 | 0.02 | 0.9825 |
| cdd*monthID | 201102 | 1.00762539 B | 0.1205422 | 8.36 | <.0001 |
| cdd*monthID | 201103 | 0.22185978 B | 0.0255465 | 8.68 | <.0001 |
| cdd*monthID | 201104 | 0.07958351 B | 0.0075044 | 10.60 | <.0001 |
| cdd*monthID | 201105 | 0.07911493 B | 0.0025031 | 31.61 | <.0001 |
| cdd*monthID | 201106 | 0.07939523 B | 0.0007300 | 108.76 | <.0001 |
| cdd*monthID | 201107 | 0.07489890 B | 0.0005254 | 142.56 | <.0001 |
| cdd*monthID | 201108 | 0.07589485 B | 0.0006331 | 119.88 | <.0001 |
| cdd*monthID | 201109 | 0.07752588 B | 0.0020414 | 37.98 | <.0001 |
| cdd*monthID | 201110 | 0.07712457 B | 0.0106534 | 7.24 | <.0001 |
| cdd*monthID | 201111 | 0.17346772 B | 0.0443337 | 3.91 | <.0001 |
| cdd*monthID | 201112 | -0.23843323 B | 0.1620752 | -1.47 | 0.1413 |
| cdd*monthID | 201201 | 0.20785646 B | 0.0531915 | 3.91 | <.0001 |
| cdd*monthID | 201202 | 0.25913327 B | 0.0486594 | 5.33 | <.0001 |
| cdd*monthID | 201203 | 0.09739021 B | 0.0093475 | 10.42 | <.0001 |
| cdd*monthID | 201204 | 0.11469817 B | 0.0060616 | 18.92 | <.0001 |
| cdd*monthID | 201205 | 0.08658451 B | 0.0018908 | 45.79 | <.0001 |
| cdd*monthID | 201206 | 0.08466735 B | 0.0008824 | 95.95 | <.0001 |
| cdd*monthID | 201207 | 0.07368587 B | 0.0005264 | 139.99 | <.0001 |
| cdd*monthID | 201208 | 0.07905480 B | 0.0006773 | 116.72 | <.0001 |
| cdd*monthID | 201209 | 0.07431302 B | 0.0018157 | 40.93 | <.0001 |
| cdd*monthID | 201210 | 0.15079504 B | 0.0104384 | 14.45 | <.0001 |
| cdd*monthID | 201211 | 0.48038836 B | 0.0548442 | 8.76 | <.0001 |
| cdd*monthID | 201212 | 3.14400440 B | 0.4670784 | 6.73 | <.0001 |
| cdd*monthID | 201301 | 0.56975469 B | 0.1465595 | 3.89 | 0.0001 |
| cdd*monthID | 201302 | 0.76368526 B | 0.2383061 | 3.20 | 0.0014 |
| cdd*monthID | 201303 | 0.14057106 B | 0.0265282 | 5.30 | <.0001 |

| Parameter | | Estimate | | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|---|
| cdd*monthID | 201304 | 0.09226234 | B | 0.0131384 | 7.02 | <.0001 |
| cdd*monthID | 201305 | 0.06593390 | B | 0.0038088 | 17.31 | <.0001 |
| cdd*monthID | 201306 | 0.07456326 | B | 0.0008957 | 83.24 | <.0001 |
| cdd*monthID | 201307 | 0.07529974 | B | 0.0006564 | 114.71 | <.0001 |
| cdd*monthID | 201308 | 0.07771548 | B | 0.0008072 | 96.27 | <.0001 |
| cdd*monthID | 201309 | 0.08431202 | B | 0.0013751 | 61.31 | <.0001 |
| cdd*monthID | 201310 | 0.12102001 | B | 0.0073569 | 16.45 | <.0001 |
| cdd*monthID | 201311 | 0.25199087 | B | 0.0497445 | 5.07 | <.0001 |
| cdd*monthID | 201312 | 0.67511172 | B | 0.0635582 | 10.62 | <.0001 |
| cdd*monthID | 201401 | 0.97797623 | B | 0.2507453 | 3.90 | <.0001 |
| cdd*monthID | 201402 | 4.29999516 | B | 0.3486099 | 12.33 | <.0001 |
| cdd*monthID | 201403 | 0.38457056 | B | 0.0323087 | 11.90 | <.0001 |
| cdd*monthID | 201404 | 0.10311979 | B | 0.0079558 | 12.96 | <.0001 |
| cdd*monthID | 201405 | 0.07420068 | B | 0.0019305 | 38.44 | <.0001 |
| cdd*monthID | 201406 | 0.07537367 | B | 0.0008021 | 93.97 | <.0001 |
| cdd*monthID | 201407 | 0.07438252 | B | 0.0009009 | 82.56 | <.0001 |
| cdd*monthID | 201408 | -0.00035747 | B | 0.0232243 | -0.02 | 0.9877 |
| hdd*monthID | 201011 | -0.13304777 | | 0.0103494 | -12.86 | <.0001 |
| hdd*monthID | 201012 | 0.04141844 | | 0.0003951 | 104.82 | <.0001 |
| hdd*monthID | 201101 | 0.04408070 | | 0.0003038 | 145.12 | <.0001 |
| hdd*monthID | 201102 | 0.04468261 | | 0.0005760 | 77.58 | <.0001 |
| hdd*monthID | 201103 | 0.04971754 | | 0.0009587 | 51.86 | <.0001 |
| hdd*monthID | 201104 | 0.07141765 | | 0.0028957 | 24.66 | <.0001 |
| hdd*monthID | 201105 | 0.12641956 | | 0.0101477 | 12.46 | <.0001 |
| hdd*monthID | 201106 | 0.12548474 | | 0.0312087 | 4.02 | <.0001 |
| hdd*monthID | 201107 | 0.21061278 | | 0.0739400 | 2.85 | 0.0044 |
| hdd*monthID | 201108 | 0.48853786 | | 0.0699229 | 6.99 | <.0001 |
| hdd*monthID | 201109 | 0.13973767 | | 0.0100157 | 13.95 | <.0001 |
| hdd*monthID | 201110 | 0.07365867 | | 0.0021197 | 34.75 | <.0001 |
| hdd*monthID | 201111 | 0.05473029 | | 0.0008758 | 62.49 | <.0001 |
| hdd*monthID | 201112 | 0.05242333 | | 0.0005400 | 97.09 | <.0001 |
| hdd*monthID | 201201 | 0.04857181 | | 0.0004157 | 116.85 | <.0001 |
| hdd*monthID | 201202 | 0.04776258 | | 0.0005891 | 81.07 | <.0001 |
| hdd*monthID | 201203 | 0.06792506 | | 0.0015994 | 42.47 | <.0001 |
| hdd*monthID | 201204 | 0.06579443 | | 0.0028816 | 22.83 | <.0001 |
| hdd*monthID | 201205 | 0.15438145 | | 0.0076109 | 20.28 | <.0001 |
| hdd*monthID | 201206 | 0.08986214 | | 0.0308475 | 2.91 | 0.0036 |
| hdd*monthID | 201207 | 0.23735480 | | 0.0550991 | 4.31 | <.0001 |
| hdd*monthID | 201208 | 0.21913417 | | 0.0868698 | 2.52 | 0.0117 |
| hdd*monthID | 201209 | 0.19385673 | | 0.0092089 | 21.05 | <.0001 |
| hdd*monthID | 201210 | 0.06207532 | | 0.0018681 | 33.23 | <.0001 |
| hdd*monthID | 201211 | 0.05270682 | | 0.0005324 | 99.00 | <.0001 |
| hdd*monthID | 201212 | 0.05179656 | | 0.0004550 | 113.83 | <.0001 |
| hdd*monthID | 201301 | 0.04944975 | | 0.0004038 | 122.46 | <.0001 |

| Parameter | | Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| hdd*monthID | 201302 | 0.04616824 | 0.0004003 | 115.34 | <.0001 |
| hdd*monthID | 201303 | 0.04854534 | 0.0005156 | 94.15 | <.0001 |
| hdd*monthID | 201304 | 0.06273890 | 0.0020151 | 31.13 | <.0001 |
| hdd*monthID | 201305 | 0.14097334 | 0.0060986 | 23.12 | <.0001 |
| hdd*monthID | 201306 | 0.27111413 | 0.0344485 | 7.87 | <.0001 |
| hdd*monthID | 201307 | 0.75227106 | 0.5459625 | 1.38 | 0.1682 |
| hdd*monthID | 201308 | 0.64648682 | 0.0836063 | 7.73 | <.0001 |
| hdd*monthID | 201309 | 0.23497863 | 0.0125078 | 18.79 | <.0001 |
| hdd*monthID | 201310 | 0.07431079 | 0.0020218 | 36.75 | <.0001 |
| hdd*monthID | 201311 | 0.05209481 | 0.0006242 | 83.46 | <.0001 |
| hdd*monthID | 201312 | 0.04551292 | 0.0005830 | 78.07 | <.0001 |
| hdd*monthID | 201401 | 0.04740798 | 0.0003332 | 142.29 | <.0001 |
| hdd*monthID | 201402 | 0.04654439 | 0.0003836 | 121.35 | <.0001 |
| hdd*monthID | 201403 | 0.04988105 | 0.0005253 | 94.95 | <.0001 |
| hdd*monthID | 201404 | 0.06945916 | 0.0018043 | 38.50 | <.0001 |
| hdd*monthID | 201405 | 0.15354932 | 0.0064585 | 23.77 | <.0001 |
| hdd*monthID | 201406 | 0.39260212 | 0.0408723 | 9.61 | <.0001 |
| hdd*monthID | 201407 | 18.42271508 | 6.4661767 | 2.85 | 0.0044 |
| hdd*monthID | 201408 | -36.33626290 | 215.5990767 | -0.17 | 0.8662 |
| k12_date | | -0.06574948 | 0.2929747 | -0.22 | 0.8224 |
| Insul_Seal_date | | -1.68582223 | 6.2833457 | -0.27 | 0.7885 |
| Free_CFL | | 0.27569834 | 0.0981067 | 2.81 | 0.0050 |
| cfl_promo | | 1.56743195 | 5.1477852 | 0.30 | 0.7608 |
| cfl_special | | -0.19005964 | 1.3100903 | -0.15 | 0.8847 |
| HEHC | | 0.85054143 | 0.5368744 | 1.58 | 0.1131 |
| lowinc_weath | | 2.41266070 | 1.4140526 | 1.71 | 0.0880 |
| PER_OHEC | | -0.73461637 | 0.5426533 | -1.35 | 0.1758 |
| SmSvr_HVAC | | 0.37324155 | 1.3090581 | 0.29 | 0.7756 |
| Appl_Recycle | | -0.14340946 | 0.8868349 | -0.16 | 0.8715 |
| Property_Mgr | | -0.62212566 | 0.1640377 | -3.79 | 0.0001 |
| MyHER | | -0.35044884 | 0.1004404 | -3.49 | 0.0005 |
| part | | -1.07687179 | 0.1173765 | -9.17 | <.0001 |

# Appendix C: Engineering Algorithms

## CFLs

### General Algorithm

Gross Summer Coincident Demand Savings

$$\Delta kW = ISR \times units \times \left[\frac{Watts_{base} - Watts_{ee}}{1000}\right] \times CF \times WHF_d$$

Gross Annual Energy Savings

$$\Delta kWh = ISR \times units \times \left[\frac{(Watts \times HOURS)_{base} - (Watts \times HOURS)_{ee}}{1000}\right] \times 365 \times WHFe$$

where:

$\Delta kW$ = gross coincident demand savings
$\Delta kWh$ = gross annual energy savings
units = number of units installed under the program
$Watts_{ee}$ = connected load of energy-efficient lamp = 15.8
$Watts_{base}$ = connected load of baseline lamp
HOURS = Average daily hours of use
CF = coincidence factor = 0.081
WHFe = Waste heat factor for annual electricity consumption = 0.963
WHFd = Waste heat factor for demand = 1.169

The coincidence factor for this analysis was taken from Duke Energy's residential lighting logger study performed in the Carolinas with participants from the 2012 CFL campaigns.

The waste heat factor for annual energy consumption depends on the HVAC system, heating fuel type, and location. The waste heat factors for annual energy consumption were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. The weights were determined through appliance saturation data from the Home Profile Database supplied by Duke Energy.

**Charlotte, NC**

| Heating Fuel | Heating System | Cooling System | Weight | WHFe |
|---|---|---|---|---|
| Other | Any except Heat Pump | Any except Heat Pump | 0.0042 | 1.069 |
| | | None | 0.0004 | 0 |
| Any | Heat Pump | Heat Pump | 0.2782 | 0.9 |
| Gas Propane Oil | Central Furnace | None | 0.0067 | 0 |
| | | Room/Window | 0.5508 | 1.069 |
| | | Central AC | | 1.069 |
| Electricity | Electric baseboard/ central furnace | None | 0.0030 | 0.57 |
| | | Room/Window | 0.1493 | 0.69 |
| | | Central AC | | 0.69 |
| None | None | Any | 0.0074 | 1 |
| Total Weighted Average | | | 1 | 0.963 |

The waste heat factor for demand depends on the cooling system type. The HVAC interaction factors for summer peak demand were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix.

**Charlotte, NC**

| Cooling System | Weight | WHFd |
|---|---|---|
| None | 0.0074 | 0 |
| All other | 0.9926 | 0.170 |
| Total Weighted Average | | 0.169 |

## Air Sealing – Reduce Infiltration Measures

**Gross Summer Coincident Demand Savings**

$\Delta kW_S = \text{units} \times (\Delta cfm/unit) \times (kW / cfm) \times DF_S \times CF_S$

**Gross Annual Energy Savings**

$\Delta kWh = \text{units} \times (\Delta cfm/unit) \times (kWh / cfm)$

$\Delta therm = units \times (\Delta cfm / unit) \times (therm / cfm)$

where:

| | |
|---|---|
| ΔkW | = gross coincident demand savings |
| ΔkWh | = gross annual energy savings |
| units | = number of buildings sealed under the program |
| Δcfm/unit | = unit infiltration airflow rate ($ft^3$/min) reduction for each measure |
| DF | = demand diversity factor = 0.8 |
| CF | = coincidence factor = 1.0 |
| kW/cfm | = demand savings per unit cfm reduction |
| kWh/cfm | = electricity savings per unit cfm reduction |
| therm/cfm | = gas savings per unit cfm reduction |

**Unit cfm savings per measure**

The cfm reductions for each measure were estimated from equivalent leakage area (ELA) change data taken from the ASHRAE Handbook of Fundamentals (ASHRAE, 2001). The equivalent leakage area changes were converted to infiltration rate changes using the Sherman-Grimsrud equation:

$$Q = ELA \times \sqrt{A \times \Delta T + B \times v^2}$$

where:

A = stack coefficient ($ft^3/min\text{-}in^{4}\text{-}°F$)
= 0.015 for one-story house

ΔT = average indoor/outdoor temperature difference over the time interval of interest (°F)

B = wind coefficient ($ft^3/min\text{-}in^4\text{-}mph^2$)
= 0.0065 (moderate shielding)

v = average wind speed over the time interval of interest measured at a local weather station at a height of 20 ft (mph)

The location specific data are shown below:

| Location | Average outdoor temp | Average indoor/outdoor temp difference | Average wind speed (mph) | Specific infiltration rate ($cfm/in^2$) |
|---|---|---|---|---|
| Charlotte | 60 | 8 | 6.9 | 1.57 |

Measure ELA impact and cfm reductions are as follows:

| Measure | Unit | ELA change ($in^2$/unit) | ΔCfm/unit |
|---|---|---|---|
| Weather stripping | Linear foot | 0.089 | 0.058 |
| Caulking | linear foot | 0.047 | 0.031 |
| Door Sweeps | each | 0.3 | 0.197 |
| Foam Insulation Spray | sink | 0.6 | 0.392 |

**Unit energy and demand savings**

The energy and peak demand impacts of reducing infiltration rates were calculated from infiltration rate parametric studies conducted using the DOE-2 residential building prototype models, as described at the end of this Appendix. The savings per cfm reduction by heating and cooling system type are shown below. These data were weighted according to the HVAC system type weights shown above.

| Heating Fuel | Heating System | Cooling System | kWh/cfm | kW/cfm | therm/cfm |
|---|---|---|---|---|---|
| Other | Any except Heat Pump | Any except Heat Pump | 2.48 | 0.00248 | 0 |
| Any | Heat Pump | Heat Pump | 10.37 | 0.00248 | 0 |
| Gas Propane Oil | Central Furnace | None | 0 | 0 | 0.0743 |
| | | Room/Window | 2.48 | 0.00248 | 0.0743 |
| | | Central AC | 2.48 | 0.00248 | 0.0743 |
| | Other | None | 0 | 0 | 0.0743 |
| | | Room/Window | 2.48 | 0.00248 | 0.0743 |
| | | Central AC | 2.48 | 0.00248 | 0.0743 |
| Electricity | Central furnace | None | 17.01 | 0.00990 | 0.000 |
| | | Room/Window | 18.54 | 0.01485 | 0.000 |
| | | Central AC | 18.54 | 0.01485 | 0.000 |
| | | | | | |
| | Electric baseboard | None | 17.01 | 0.00990 | 0.000 |
| | | Room/Window | 18.54 | 0.01485 | 0.000 |
| | | Central AC | 18.54 | 0.01485 | 0.000 |
| | | | | | |
| | Other | None | 17.01 | 0.00990 | 0.000 |
| | | Room/Window | 18.54 | 0.01485 | 0.000 |
| | | Central AC | 18.54 | 0.01485 | 0.000 |
| | | | | | |
| Total Weighted Average | | | 7.21 | 0.00439 | 0.0414 |

## Low-Flow Showerhead

Gross Summer Coincident Demand Savings

$$\Delta kW_S = units \times ISR \times \%Elec \times \frac{(GPD_{base} - GPD_{ee}) \times 8.33 \times \overline{\Delta T}}{3412 \times 24 \times RE} \times DF_x \times CF_s$$

Gross Annual Energy Savings

$$\Delta kWh = units \times ISR \times \%Elec \times \frac{(GPD_{base} - GPD_{ee}) \times 8.33 \times \overline{\Delta T}}{3412 \times RE} \times 365$$

where:

| | |
|---|---|
| ΔkW | = gross coincident demand savings |
| ΔkWh | = gross annual energy savings |
| units | = number of units installed under the program |
| $GPD_{base}$ | = daily hot water consumption before installation |
| $GPD_{ee}$ | = daily hot water consumption after flow reducing measure installation |
| ΔT | = average difference between entering cold water temperature and the shower use temperature |
| RE | = water heater recovery efficiency (0.98) |
| DF | = demand diversity factor for electric water heating |

| | |
|---|---|
| CF | = coincidence factor |
| 8.33 | = conversion factor (Btu/gal-°F) |
| 3412 | = conversion factor (Btu/kWh) |
| 24 | = conversion factor (hr/day) |
| 365 | = conversion factor (days/yr) |
| 100000 | = conversion factor (Btu/therm) |

Showerhead

$GPD_{base}$ = showers/week / 7 x 2.87 gpm x 5 minutes/shower

$GPD_{ee}$ = showers/week / 7 x 1.75 gpm x 5 minutes/shower

Showers/wk = 10.9 per showerhead (from survey data)

ΔT

| City | Average cold water temperature | Shower use temperature | Average ΔT |
|---|---|---|---|
| Charlotte | 60.3 °F | 100°F | 39.7°F |

Demand diversity factor = 0.1

Coincidence factor = 0.4

The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for the residential water heating end-use in a summer peaking utility.

### Faucet Aerators

ΔkWH = ISR * ((((GPMbase - GPMlow) / GPMbase) * # people * gals/day * days/year * DR) / F/home) * 8.3 * (Tft - Tmains) / 1,000,000) / DHW Recovery Efficiency / 0.003412

Where:

ISR = In Service Rate or fraction of units that get installed
GPMbase = Gallons Per Minute of baseline faucet = 2.2
GPMlow = Gallons Per Minute of low flow faucet = 1.5
# people = Average number of people per household = 2.46
gals/day = Average gallons per day used by all faucets in home = 10.9
days/y = Days faucet used per year = 365
DR = Percentage of water flowing down drain (if water is collected in a sink, a faucet aerator will not result in any saved water) = 50%
F/home = Average number of faucets in the home = 3.5
8.3 = Constant to convert gallons to lbs

Tft = Assumed temperature of water used by faucet = 80
Tmains = Assumed temperature of water entering house = 60.3
DHW Recovery Efficiency = Recovery efficiency of electric hot water heater = 0.98
0.003412 = Constant to converts MMBtu to kWh

ΔkW = ΔkWh/hours * CF

Where:
Hours = Average number of hours per year spent using faucet
= (Gal/person * # people * 365) / F/home / GPM / 60
= (10.9 * 2.46 * 365) / 3.5 / 2.2 / 60
= 21 hours
CF = Summer Peak Coincidence Factor for measure = 0.00262

### Hot Water Pipe Wrap

For electric DHW systems:

ΔkWh = ((1/Rexist – 1/Rnew) * (L * C) * ΔT * 8,760)/ ηDHW / 3413

Where:
Rexist = Pipe heat loss coefficient of uninsulated pipe (existing) (Btu/hr-°F-ft) = 1.0
Rnew = Pipe heat loss coefficient of insulated pipe (new) (Btu/hr-°F-ft) = 5
L = Length of pipe from water heating source covered by pipe wrap (ft)
C = Circumference of pipe (ft) (Diameter (in) * π * 0.083) = 0.196ft
ΔT = Average temperature difference between supplied water and outside air temperature (°F) = 60°F
8,760 = Hours per year
ηDHW = Recovery efficiency of electric hot water heater = 0.98
3413 = Conversion from Btu to kWh

ΔkW = ΔkWh/8760

Where:
ΔkWh = kWh savings from pipe wrap installation
8760 = Number of hours in a year (since savings are assumed to be constant over year).

### Water Heater Tank Wrap and Temperature Turn-Down

$$\Delta kWh = units \times \frac{(UA_{base} - UA_{ee}) \times \overline{\Delta T}}{3413 \times \eta_{elec}} \times 8760$$

$\Delta kW = \Delta kWh/8760$

Where:

$\Delta kW$ = gross coincident peak demand savings
$\Delta kWh$ = gross annual electricity savings
units = number of water heaters installed under the program
UAbase= overall heat transfer coefficient of base water heater (Btu/hr-°F) = 4.1
UAee= overall heat transfer coefficient of improved water heater (Btu/hr-°F) = 3.3
$\Delta T$ = temperature difference between the water inside the tank and the ambient air (°F) = 60
3413 = conversion factor (Btu/kWh)
8760 = conversion factor (hr/yr)
$\eta$elec= electric water heater recovery efficiency = 0.98

Tank heat loss coefficients estimated from the energy factor:

$$UA = \frac{\frac{1}{EF} - \frac{1}{RE}}{67.5 \times \left(0.000584 - \frac{1}{RE \times Cap}\right)}$$

where: Cap = tank element heat output =15,400 Btu/hr

The EF for uninsulated (0.86) and insulated (0.88) tanks were taken from the Draft Ohio TRM.

## Prototypical Building Model Description

The impact analysis for many of the HVAC related measures are based on DOE-2.2 simulations of a set of prototypical residential buildings. The prototypical simulation models were derived from the residential building prototypes used in the California Database for Energy Efficiency Resources (DEER) study (Itron, 2005), with adjustments make for local building practices and climate. The prototype "model" in fact contains 4 separate residential buildings; 2 one-story and 2 two-story buildings. The each version of the 1 story and 2 story buildings are identical except for the orientation, which is shifted by 90 degrees. The selection of these 4 buildings is designed to give a reasonable average response of buildings of different design and orientation to the impact of energy efficiency measures. A sketch of the residential prototype buildings is shown in Figure 9.

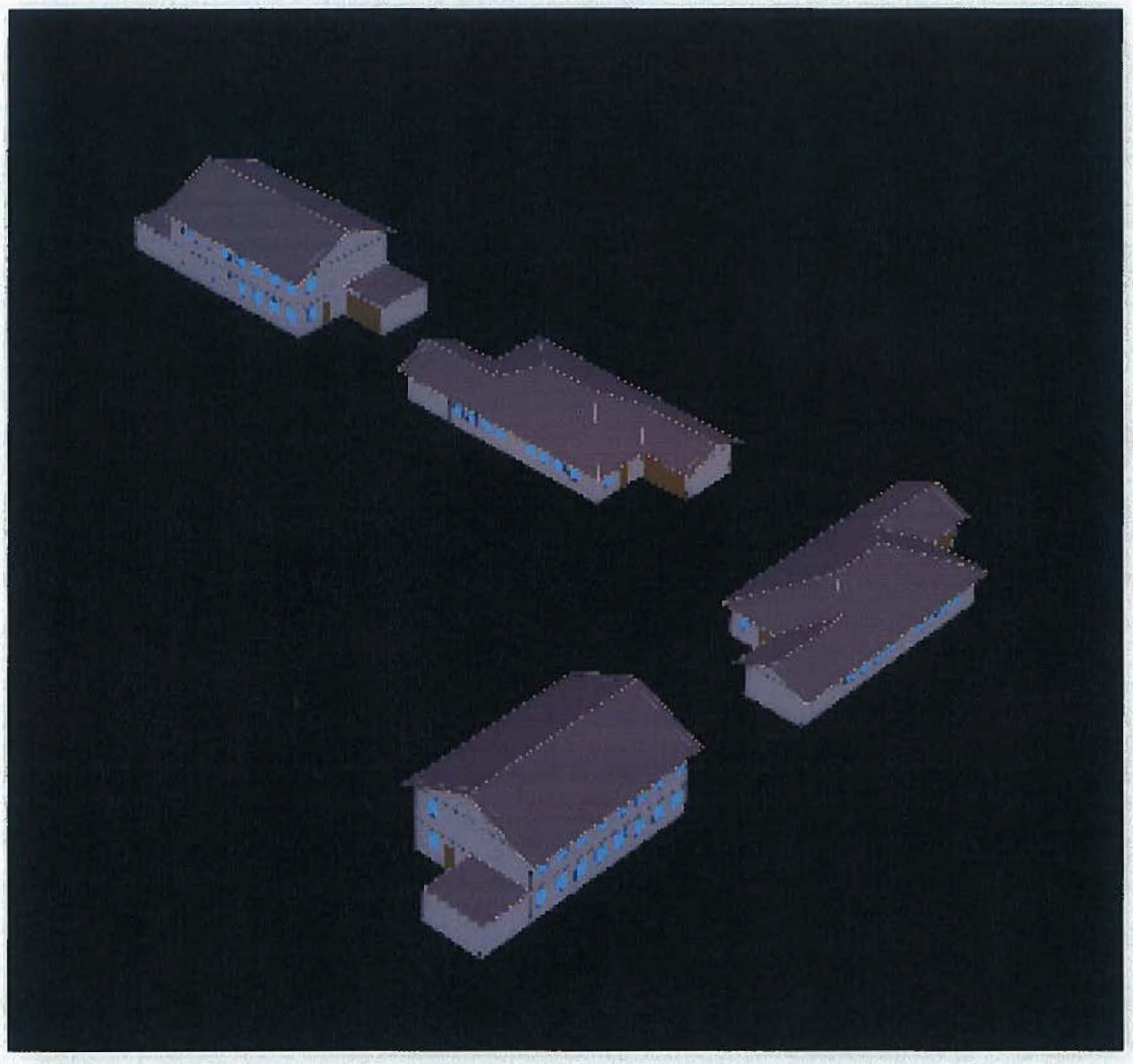

**Figure 9. Computer Rendering of Residential Building Prototype Model**

The general characteristics of the residential building prototype model are summarized below:

**Residential Building Prototype Description**

| Characteristic | Value |
|---|---|
| Conditioned floor area | 1 story house: 1465 SF<br>2 story house: 2930 SF |
| Wall construction and R-value | Wood frame with siding, R-11 |
| Roof construction and R-value | Wood frame with asphalt shingles, R-19 |
| Glazing type | Single pane clear |
| Lighting and appliance power density | 0.51 W/SF average |
| HVAC system type | Packaged single zone AC or heat pump |
| HVAC system size | Based on peak load with 20% oversizing. Average 640 SF/ton |
| HVAC system efficiency | SEER = 8.5 |
| Thermostat setpoints | Heating: 70°F with setback to 60°F<br>Cooling: 75°F with setup to 80°F |

| Characteristic | Value |
|---|---|
| Duct location | Attic (unconditioned space) |
| Duct surface area | Single story house: 390 SF supply, 72 SF return<br>Two story house: 505 SF supply, 290 SF return |
| Duct insulation | Uninsulated |
| Duct leakage | 26%; evenly distributed between supply and return |
| Cooling season | Charlotte – April 17th to October 6th |
| Natural ventilation | Allowed during cooling season when cooling setpoint exceeded and outdoor temperature < 65°F. 3 air changes per hour |

## References

Itron, 2005. "2004-2005 Database for Energy Efficiency Resources (DEER) Update Study, Final Report," Itron, Inc., J.J. Hirsch and Associates, Synergy Consulting, and Quantum Consulting. December, 2005. Available at http://eega.cpuc.ca.gov/deer

# Appendix D: Memo: Low Income Programs and Freeridership


TecMarket Business Center
165 Netherwood Road
2nd Floor, Suite A
Oregon, WI 53575

## Memorandum

To: Roshena Ham, Duke Energy
From: Nick Hall, David Ladd, TecMarket Works, and Matthew Joyce
Date: January 15, 2014
Subject: Low Income Programs and Freeridership

On October 29, 2013, the North Carolina Public Utility Commission issued an order approving Duke Energy's Rider filing. Ordering Paragraph 8 of this order states:

> *That in future EM&V studies, DEC shall either specifically assess free ridership of low-income programs and incorporate the findings from participant surveys into the Company's free ridership calculations or shall provide justification showing that such assessment is unnecessary or that using a specific proxy for a free ridership estimate is reasonable.*[43]

This memorandum addresses that statement as follows.

Typically, low income evaluation studies have indicated that program participation by people near 150% of federal poverty thresholds have zero to very low freeridership levels. Studies have found that low-income households do not typically invest in energy-efficient measures on their own, but tend to acquire them via utility programs, social programs, low-income support efforts, and promotional giveaways. The higher price of consumable measures (such as CFLs versus incandescent bulbs), and the capital investment required for home improvements such as high efficiency HVAC and other equipment upgrades, represents a significant cost barrier for low income populations. Occasionally these economic realities appear to be at odds with freeridership survey data.

Within the field of survey research there is the concept of socially acceptable response bias in which people respond to questions regarding their behavior in a way that reflects what they think is the socially correct answer. This concept applies to market segments

[43] Order approving DSM/EE Rider and Requiring Filing of Proposed Customer Notice, filed October 29, 2013, in *Application Approval of Demand Side Management and Energy Efficient Cost Recovery Rider*, Docket Number E-7 Sub 1031.

differently. For example, the low-income sector does not want to be seen as being unable to do the "correct" behavior, so they respond that they would have done that "correct" behavior even when they do not have the resources to undertake that behavior. This is the reason why we sometimes see freerider scores within market sectors that do not have the financial capability to take a more costly action, but still report that they would have taken that action in the absence of the program. The degree of this false response bias is not known, however the concept, especially within the low-income sector responding to questions about what they perceive as socially acceptable behavior, is widely held with the social research community.

As a result, the NTG ratio used within the energy program evaluation community for low-income programs is typically set in both policy decisions and supported in evaluation findings at around 1.0, representing few freeriders associated with utility-sponsored programs. Historically the net-to-gross ratio of 1.0 has been applied to numerous low income program evaluations. For example, the table below lists examples from thirteen evaluation reports, policy documents, evaluation plans, annual reports, conference papers, commission hearings and Public Utility Commission case documents of the past ten years covering multiple states and jurisdictions.

A list of references for these documents follows the table, including URLs for documents currently available online.

The review of the research conducted on this topic as summarized below (with findings highlighted), provides sufficient justification that evaluations for utility energy efficiency programs, including Duke Energy's, continue the use of a 0% freeridership rates for low-income programs.

| State and Year | Document | Low Income NTG policy/approach |
|---|---|---|
| Pennsylvania 2012 | Evaluation Framework 2013 | • Quote: *"[The] Commission recognizes that the calculation of NTG ratios is inexact at best. 'Free riders' are difficult and expensive to calculate, but even more difficult and costly to calculate is 'spillover'."*[67] *The PA PUC believes that, based on published studies, these two effects often come close to offsetting each other and result in a NTG ratio close to 1.0.*[68] [See TecMarket Works comment in bullet below] *Due to the substantial additional costs to calculate "freeriders" and "spillover," the PA PUC questions whether it is cost-effective to use ratepayer funds for these analyses, only to find that the NTG ratio is close to 1.0. No stakeholders have provided evidence to the contrary, so the PA PUC will continue to mandate that the EDCs calculate the NTG ratio as they did for Phase I."*[69] Footnote text: [69] *"Pennsylvania Public Utility Commission, Energy Efficiency and Conservation Program Implementation Order, at page 83, at Docket No M-2012-2289411, (Phase II Implementation Order), entered August 3, 2012."* p. 59<br>• TecMarket Works comment: Without counting the additional market effects induced energy savings. |
| Pennsylvania | PPL Annual | • Summary: Net to Gross ratio set to 1.0 for Low-Income WRAP |

| State and Year | Document | Low Income NTG policy/approach |
|---|---|---|
| 2010 | Report | program. p. 9<br>• Quote: *"There is no free-ridership in this low income weatherization program. Measures are installed at no cost to these income eligible customers. In addition, no adjustments were made to compute savings net of freeridership for the Act 129 programs. Until directed otherwise by the SWE, the EM&V CSP will collect data and report the information for program process improvements only."* p. 58 |
| New York 2007-2008 | Evaluation Plan 2013 | • Quote: *"The primary method of estimating program impacts for 2007-2008 CY participants was a full billing analysis. Impact evaluations of low income programs often exclude evaluation of Net-to-Gross (NTG) under the presumption that free ridership and spillover effects are small and offset each other. The prior evaluation's pilot NTG study found that for EmPower the factors virtually offset each other and recommended a NTG rate of 1.0. Therefore, a NTG assessment is excluded from the first cycle evaluation scope."* p. 8-9.<br>• TecMarket Works comment: At this time there are no recommendations or considerations being contemplated by the NY Commission to change the 1.0 NTG assumption. (Mr. Hall is the lead advisor to the NY Commission on evaluation research approaches and lead evaluation manager for the development of NY evaluation protocols and technical manuals providing policy oversight to all evaluation contactors conducting studies in NY.) |
| New York 2007-2008 | Impact Evaluation Report | • Quote: *"For EmPower, as is the case for many low income efficiency retrofit programs, the assumption has been that the net-to-gross ratio (NTGR) is 1.0, that is, that the program does not have free riders or spillover. A pilot net-to-gross (NTG) study was conducted to assess the validity of this assumption. The pilot effort indicates that both free ridership and spillover occur within the low income population. The NTG approach was consistent with the methods used in the evaluation of other NYSERDA programs, and the results indicate a free rider rate of 17% and spillover of 14%, for a combined NTG of 0.97. The program savings were not adjusted by the NTG ratio since this initial study was designed as a pilot. In addition, the NTG ratio of 0.97 is extremely close to the value of 1.00 currently in use."* Executive Summary p. 2<br>• Quote: *"The pilot study of net effects clearly demonstrated that there are net effects associated with the Empower Program. With an estimated FR rate of 17% and spillover of 14%, the overall NTGR is 0.97, which is very close to the current estimate of 1.00. Since this was a pilot effort and the result was so close to 1.00, the evaluated gross savings are reported for the Program without any adjustments for net effects. However, this study reflects the results for program years 2007 and 2008, and it is possible that the magnitude of the net effects may change in the future."* Executive Summary p. 9<br>• Quote: *"The 2007-2008 CY evaluation concluded the share of savings from large multi-family buildings did not warrant a separate NTG analysis at that time." Footnote text: "The pilot NTG evaluation undertaken as part of the CY 2007-2008 evaluation found a NTG ratio of approximately 1.0. A NTG of 1.0* |

| State and Year | Document | Low Income NTG policy/approach |
|---|---|---|
| | | *is a common assumption for low income evaluations."* p. 9 footnote |
| Michigan 2012 | Utilities Commission Hearing | • *Quote: "Consumers Energy also proposes to maintain the 1.0 NTG ratio for its pilot, low income, and educational programs." (Proposal approved by Public Services Commission) p. 4* |
| Wyoming 2011 | Impact Evaluation Report | • Quote: *"Low-income programs generally experience no freeridership or spillover; consequently net program savings equal gross program savings."* p. 2-4 |
| Nevada 2009 | Nevada Power Integrated Resource Plan 2010 to 2029 | • Summary: Freeridership rates for Low Income Weatherization NPC NTGRs = 0.0% Table 49: Demand Side Plan p. 95<br>• Quote: *"The Commission order in Docket No. 06-08020, refer to stipulation, paragraph 4, the order stated that "freeridership or spillover do not need to be considered in the financial analysis of the low-income programs. Net-to-Gross Ratio of 100% has been used in the economic evaluation of this program."* Section C, p. 15 |
| Maine 2007 | Impact Evaluation Report | • Quote: *"Freeridership, defined as program purchases that participants claim they would have made on their own in the absence of the program, was assumed to be zero because the refrigerators and CFLs were provided free of charge."* p. 83 |
| Ontario 2005 | Ontario Energy Board Case Document | • Quote: *"Therefore the rule of thumb estimate for programs specifically targeted at low income customers ought to be zero."* p. 9 |
| General 2011 | IEPEC conference poster | • Quote: *"Freeridership is not usually considered to be an important issue in the evaluation of low - income efficiency programs, as participants in these programs rarely undertake energy efficiency improvements in the absence of the program."* p. 3 |
| Wisconsin 2009-2010 | IEPEC conference paper | • Summary: *All energy savings from large multifamily building direct-install weatherization programs including low-income are due to the intervention of the EE program.* (see discussion on p. 2-4) |

## References:

1. *"State of North Carolina Utilities Commission Docket No. E-7, Sub 2031: In the Matter of Application of Duke Energy Carolinas, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider", June 4, 2013, page 21.*
2. *Statewide Evaluation Team (GDS Associates, Nexant, Research Into Action, Apex Analytics), "Evaluation Framework for Pennsylvania Act 129 Phase II Energy Efficiency and Conservation Programs", Public Utilities Commission, Pennsylvania, 2013, page 59. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseII-Evaluation_Framework063013.pdf*
3. *PPL Electric and The Cadmus Group, "Annual Report to the Pennsylvania Public Utility Commission for the period ending May 2010 Program Year 1", Public Utilities Commission, Pennsylvania, 2010, pages 9, 58. https://www.pplelectric.com/save-energy-and-money/~/media/PPLElectric/Shared%20Content/master-pages/act-129/Docs/energy_efficiency/PY1_AnnualReport_Final_091410.pdf*
4. *NYSERDA, "EmPower Program Final Detailed Evaluation Plan", March 28, 2013, pages 8-9.*
5. *Medgal & Associates for NYSERDA, "2007-2008 Empower New York Program Impact Report", April 2012, pages ES-2, ES-9.*

6. *"State of Michigan Public Services Commission Case No. U-16670: In the Matter of the Application of Consumers Energy Company to Amend Its Energy Optimization Plan", November 7, 2012, page 4. http://efile.mpsc.state.mi.us/efile/docs/17138/0009.pdf*
7. *The Cadmus Group for Rocky Mountain Power Wyoming "Low-Income Weatherization Program Evaluation", October 18, 2011, page 11. http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/DSM_WY_LowIncome_Weath_2011.pdf*
8. *Nevada Power, "Triennial Integrated Resource Plan 2010-2029: Demand Side Plan, Vol. 5 Book 1", 2009, Table 49: Demand Side Plan page 95 and Section C page 15. http://www.swenergy.org/news/news/documents/file/2009-07-NV_Power_DSM_Plan_01.pdf*
9. *Nexus Market Research and RLW Analytics for Efficiency Maine, "Process and Impact Evaluation of the Low Income Appliance Replacement Program", December 21, 2007, page 83.*
10. *Indeco Strategic Consulting for Ontario Energy Board, "CDM Free Riders and Attribution Benefits", 2005, page 9. http://www.ontarioenergyboard.ca/documents/cases/EB-2005-0523/honi_submission_tabd_211205.pdf*
11. *Jacqueline Berger of APPRISE (Applied Public Policy Research Institute for Study and Evaluation), "Evaluating Low - Income Energy Efficiency Programs" Poster Summary, presented at IEPEC 2011 conference, Boston, page 3. http://www.iepec.org/conf-docs/papers/2011PapersTOC/papers/141.pdf#page=1*
12. *Don Hynek, Barbara Smith and Megan Levy of Wisconsin Division of Energy Services, "The Great White Whale in Weatherization: A Large Multifamily Building Program" presented at the 2011 IEPEC conference, Boston, pages 2-4. http://www.iepec.org/conf-docs/papers/2011PapersTOC/papers/007.pdf*

# Appendix E: Management Interview Instrument

**We are conducting this interview to obtain your opinions about and experiences with the Residential Neighborhood program. We'll talk about the Residential Neighborhood program and its objectives, your thoughts on improving the program, and the technologies the program covers. The purpose of this study is to capture the program's current operations as well as help identify areas where the program might be improved. Your responses will feed into a report that will be shared with Duke Energy and the state regulatory agency. I want to assure you that the information you share with me will be kept confidential; we will not identify you by name. However, you may provide some information or opinions that could be attributed to you by virtue of your position and role in this program. If there is sensitive information you wish to share, please warn us and we can discuss how best to include that information in the report.**

**The interview will take about an hour to complete. Do you have any questions for me before we begin?**

## Program Background and Objectives

1. Please describe your role and scope of responsibility in detail.
2. How long have you been involved with the program?
3. (PM only) Describe the evolution of the Program. Why was the program created, and has the program changed since it was it first started?
4. Have there been any recent changes been made to your duties since you started?
    a. If YES, please tell us what changes were made and why they were made. What are the results of the change?
5. In your own words, please describe the Program's objectives. (e.g. enrollment, energy savings, non-energy benefits)
6. Can you please walk me through the program's implementation, starting with how the program is marketed and how you target your customers, through how the customer participates?
    a. Marketing/Targeting: How & Who
    b. Enrollment/Participation
7. Of the program objectives you mentioned earlier, do you feel any of them will be particularly easy to meet, and why?
8. Which program objectives, if any, do you feel will be relatively difficult to meet, and why?

9. Are there any objectives you feel should be revised prior to the end of this program cycle? If yes, why?

## Vendors

10. Do you use any vendors or contractors to help implement the program?
    a. What responsibilities do they have?
    b. Are there any areas in which think they can improve their services?
11. *(If not captured earlier)* Please explain how activities of the program's vendors, customers and Duke Energy are coordinated.
    a. Do you think methods for coordination should be changed in any way? If so, how and why?

## Measures/Incentives

12. Describe your quality control and process for tracking participants, shipments, and other program data.
13. Do you believe that the program currently offers the right energy efficient products to meet your customers' needs?
    a. If not, what products would you like to add?
14. Is the program offering enough of an incentive to motivate your customers to participate?
    a. If not, what do you think should be changed, and why?

## Vendor Staff Training

15. Describe any program orientation training and development approach you use for the Program.
    a. How do you ensure that staff are getting adequate program training and updated program information?
    b. Can we obtain training materials that are being used?
16. Do you have any suggestions for improving their effectiveness?

## Improvements

17. Are you currently considering any changes to the program's design or implementation?
    a. What are the changes?

b. What is the process for deciding whether or not to make these changes?

18. Do you have suggestions for improvements to the program that would increase participation rates, or is Duke Energy happy with the current level of participation?

19. Do you have suggestions for increasing energy impacts *per participant*, given the same participation rates, or is Duke Energy happy with the current per participant impact?

20. Overall, what would you say about the program is working really well?

    a. Is there anything in this program you could highlight as a best practice that other utilities might like to adopt?

21. What area needs the most improvement, if any?

    a. (If not mentioned before) What would you suggest can be done to improve this?

22. Are there any other issues or topics we haven't discussed that you feel should be included in this report?

23. Do you have any further questions for me about this study or anything else?

24. Thank you!

# Appendix F: Participant Survey Instrument

**Surveyor Name***

_____

**Survey ID***

_____

**State***
( ) Kentucky
( ) Ohio
( ) North Carolina
( ) South Carolina

**Measures***
*You must enter a number for each measure.*
*If you enter 0, no questions will be asked of that measure*

| | number |
|---|---|
| A. AC/Heat Filters Year Supply AND/OR Change Filter Calendar | _____ |
| B. Aerators | _____ |
| C. Caulking Doors | _____ |
| D. Caulking Windows | _____ |
| E. Clear Glass Patch Tape | _____ |
| F. CFL, 13 Watt | _____ |
| G. CFL, 18 | _____ |

| | |
|---|---|
| Watt | |
| H. Door Sweeps | |
| I. Foam Insulation Spray | |
| J. HVAC Winter Kit for Wall/Window Unit | |
| K. Low-flow Showerheads | |
| L. Switch Plate Wall Thermometer | |
| M. Vinyl Weather Stripping All HVAC Window Units | |
| N. Vinyl Weather Stripping Doors | |
| O. Water Heater Pipe Wrap | |
| P. Water Heater Tank Insulation Wrap | |
| Q. Water | |

| | |
|---|---|
| Heater Temperature Adjustment | |

*Complete ALL of the above information fields BEFORE calling each customer. The numbers above will be used to determine which questions are asked and imported into some questions.*

**Hello, my name is _____. I am calling from TecMarket Works on behalf of Duke Energy to conduct a customer survey about the Residential Neighborhood Program. May I speak with _____ please?**

*If person talking, proceed. If person is called to the phone reintroduce.*

*If not home, ask when would be a good time to call and schedule the call-back:*
*Interviewer: if the customer you are calling has only a small number of measures installed, tell them the survey will take "about 30 minutes". If they have a larger than average number of measures, tell them the survey will take "45 minutes to an hour". If they have an average/moderate number of measures, then tell them "about 45 minutes" as written below.*

**We are conducting this survey to obtain your opinions about the Residential Neighborhood Program in which your household participated. We are not selling anything. If you complete the survey, we will send you a $25 check for your time. The survey will take about 45 minutes, sometimes less. Your answers will be confidential, and will help us to make improvements to the program to better serve others. May we begin the survey?**

*for answering machine 1st through penultimate attempts:*
**Hello, my name is [full name] and I am calling from TecMarket Works on behalf of Duke Energy to conduct a customer survey regarding the Residential Neighborhood Program. This program provided free energy assessments and installed energy-saving improvements in your home. I am sorry I missed you. I will try again another time.**

*for answering machine - Final Attempt:*
**Hello, my name is [name] and I am calling from TecMarket Works on behalf of Duke Energy to conduct a customer survey regarding the Residential Neighborhood Program. This program provided free energy assessments and installed energy-saving improvements in your home. This is my last attempt at reaching you, my apologies for any inconvenience.**

**0. Do you still live at [*address from calling sheet*] ?***
( ) Yes
( ) No or DK/NS

**1. Do you recall participating in the Residential Neighborhood Program?***
( ) Yes
( ) No
( ) DK/NS

2. **This program was provided through Duke Energy and provided residents in your area with free home energy assessments and, if needed, the free installation of energy-saving home improvements such as insulation, weather stripping, light bulbs, faucet aerators and showerheads. Do you remember participating in this program? ***
( ) Yes
( ) No
( ) DK/NS

*If No or DK/NS terminate interview and go to next participant.*
*Click NEXT below to record this disqualification.*

**3. How did you first learn about, or hear about, Duke Energy's Residential Neighborhood Program?***
*(Check all that apply)*
[ ] Received a letter or postcard in the mail describing the program
**3a. Who sent the letter or postcard?:**
_____ *
[ ] Received a "door hanger" describing the program
**3b. Who left the door hanger?:** _____ *
[ ] Attended a community event promoting the program
[ ] Someone visited my home to tell me about the program
**3c. What organization was this person from?:**
_____ *
[ ] Someone from Duke Energy called to tell me about the program
[ ] Someone else called to tell me about the program
3d. *Specify person/organization*: _____ *
[ ] I called Duke Energy for information or help
[ ] I called someone else for information or help
3e. *Specify person/organization*: _____ *
[ ] Friends, family, or neighbors (word-of-mouth)
[ ] Media (TV, radio, newspapers, news reports, advertising, etc.)
3f. *Specify sources*: _____ *
[ ] Online (Duke Energy or any other websites)
3g. *Specify sites*: _____ *
[ ] Through another agency or organization (Church, CAP, Energy Assistance, etc.)
3h. *Specify organizations*: _____ *
[ ] Some other way
3i. *Specify*: _____ *
[ ] DK/NS