Big Energy Data-UPDATE

In our last review of 2016 smart meter data, Environmental Defense Fund (EDF) and the Citizens Utility Board (CUB) found that 97% of Commonwealth Edison customers could have saved money had they been on an hourly pricing program instead of a more traditional rate structure. Today, we ask a new question.

Question

Do low-income customers use more or less electricity than the rest of the customer base?

Background

It's a question that's been discussed and debated for years. Federal data indicates that low-income households use less energy than the average household, according to a 2002 analysis published in The Electricity Journal. [1] But "low income does not always imply low consumption," countered Serj Berelson[2] of Opower in an analysis more than a decade later. He found a wide range of usage, with some low-income customers using nearly 26% more energy per year than the general population, and others 27% less.

Here's why it's critical that we tackle such questions: Utility bills hit poor families hardest. Our friends at Elevate Energy — a group that advocates smarter energy use for all — consider a home "energy burdened" if the price tag for heating and lighting it exceeds 6% of household income. But the burden is even more traumatic in Illinois, where low-income families spend an average of 13% of their household income on energy.[3]

So there is vital need for public policy that can help reduce the energy burden for all Illinoisans.

The good news is grid modernization and the Future Energy Jobs Act — state legislation that boosts efficiency and renewable energy to historic levels — have the potential to make Illinois a national model for creative energy solutions. Moreover, for the first time in Illinois, advocates and researchers have the necessary tools to explore potential solutions, thanks to a new state tariff that gives them access to energy usage data from smart meters.

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[1] Colton, R. (April 2002). Energy consumption and expenditures by low-income customers [Abstract]. *The Electricity Journal, Volume 15*, Pages 70-75. http://www.sciencedirect.com/science/article/pii/S1040619002002798?via%3Dihub#aep-abstract-id3

[2] Berelson, S. (Opower) (2014). Myths of Low-Income Energy Efficiency Programs: Implications for Outreach [Abstract].ACEEE Summer Study on Energy Efficiency in Buildings, Pages 7-32 to 7-43. http://aceee.org/files/proceedings/2014/data/papers/7-287.pdf

[3] "Energy burden in Illinois." Fact Sheet. Elevate Energy. Chicago. May 31, 2017. Web. https://www.elevateenergy.org/wp/wp-content/uploads/Energy-Burden-in-IL.pdf

Analysis

EDF/CUB analyzed 12 months of energy-usage data, anonymized by zip code, in 2016, from the smart meters of 344,717 Commonwealth Edison residential customers. (Commonwealth Edison is the biggest electric utility in Illinois, serving about 3.6 million customers across Northern Illinois.)

Our first finding was that 97% of ComEd customers could have saved money on the company's dynamic pricing plan, called Hourly Pricing, without any behavior change. Low-income customers showed little variation from the rest of the population — the only statistically significant difference being an additional 1% savings on average. Now, we turn to the energy use of those customers.

"Low income" areas here are defined as ZIP+4 areas with 50% or more residents earning 80% or less of the Federal Poverty line for a family of four, or $19,680. This is more conservative estimate than the federal definition, which is 150% of the federal poverty line.

Findings

Low-income household energy usage was 15.9% less on average annually than that of the non-low-income population. Figure 1 compares average usage (monthly, annual) and electric bills. Each of these differences are statistically significant with 99% confidence.

Because of ComEd's smart meter deployment schedule, the current sample of households has a higher proportion of urban residents than the entire utility footprint. Figure 1 also compares income groups according to housing characteristics, showing low-income customers in the sample are more likely to live within the Chicago city limits and to live in multi-family housing.

Figure 1

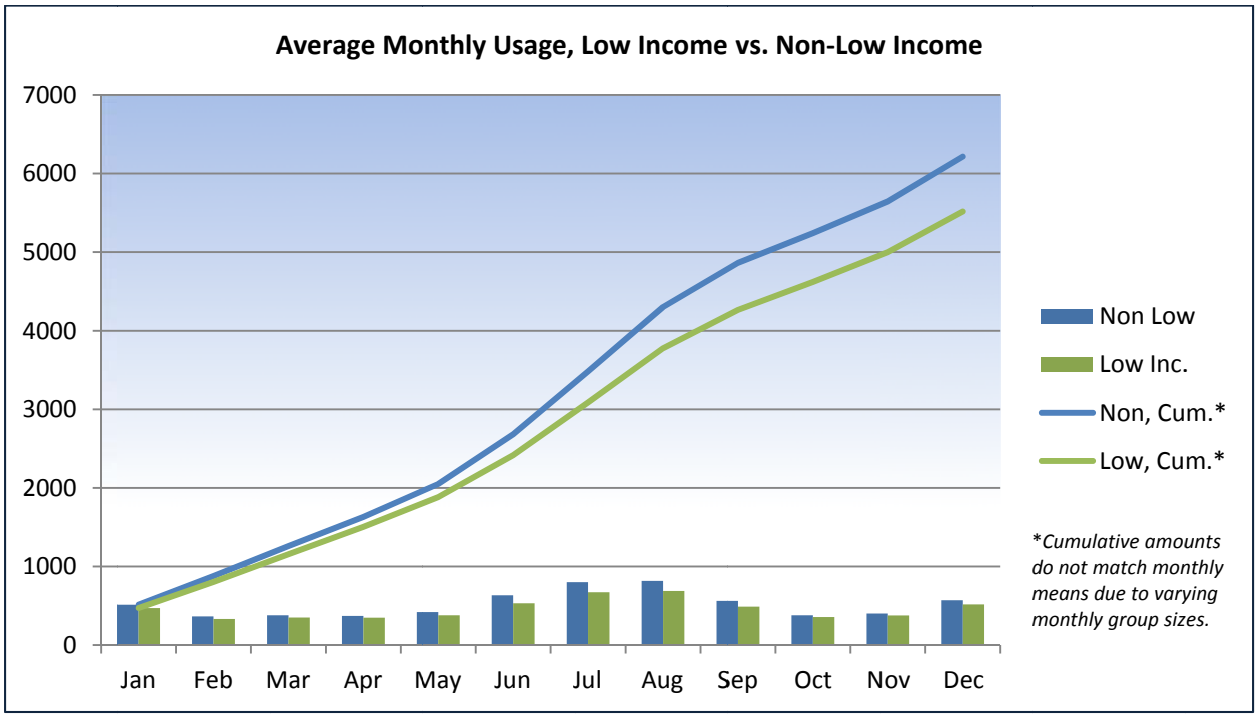
Income Group Statistics	**Low Income**		**Non-Low Income**	
	Annual	*Monthly*	*Annual*	*Monthly*
Avg. Usage (kWh)	4412	449	5250	518
Avg. Bill	$561.21	$46.77	$652.31	$54.34
Group Makeup	*Yes*	*No*	*Yes*	*No*
Chicago?	63.2%	36.8%	54.6%	45.4%
Space Heat?	4.2%	95.8%	5.2%	94.8%
Single Fam?	41.5%	58.5%	58.6%	41.5%

The difference in monthly usage is consistent throughout 2016. Figure 2 shows average monthly usage and cumulative monthly averages. (Note: Each monthly difference in usage was also significant with 99% confidence.)

The difference is highest during the summer months, when ComEd's capacity obligation – an estimate of the highest demand it must meet and a key factor in the amount customers pay for electricity service – is typically calculated. Low-income customers used an average of **19% less electricity from June through September**, compared to an average of **9% less during the winter months**.

Typically, electric utilities take a universal approach to determine capacity costs across residential customer classes, with little or no variation. **These results indicate that in 2016 low-income customers in this sample had a lower contribution to the capacity component of delivery charges in the following years.** That suggests a more customized approach – where capacity costs are estimated and allocated on an individual basis instead of class average – would be beneficial for low-income consumers.

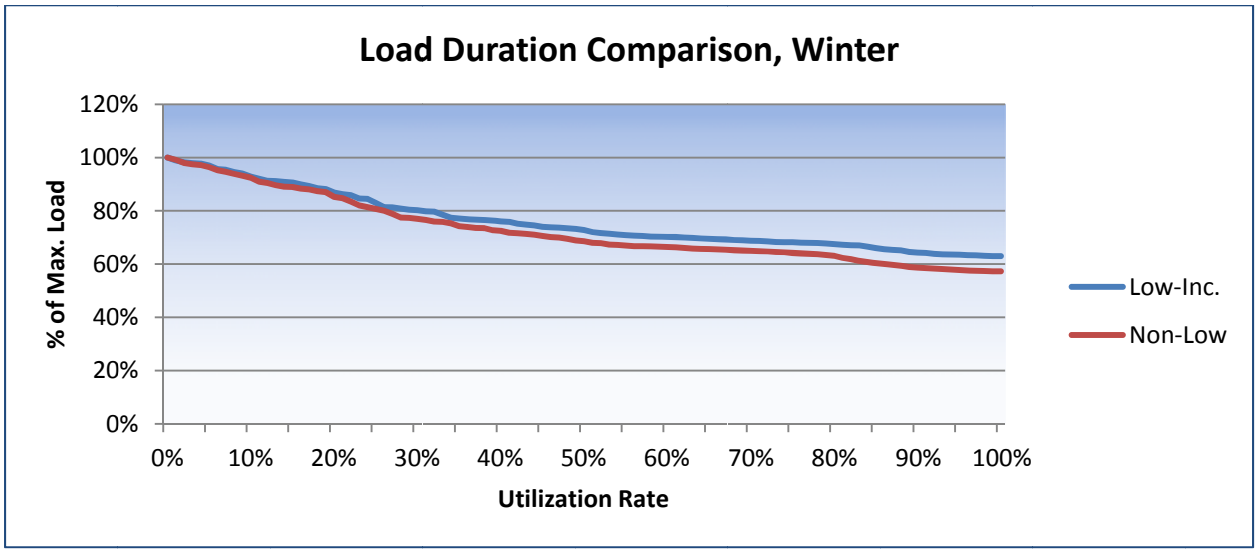
Figure 2

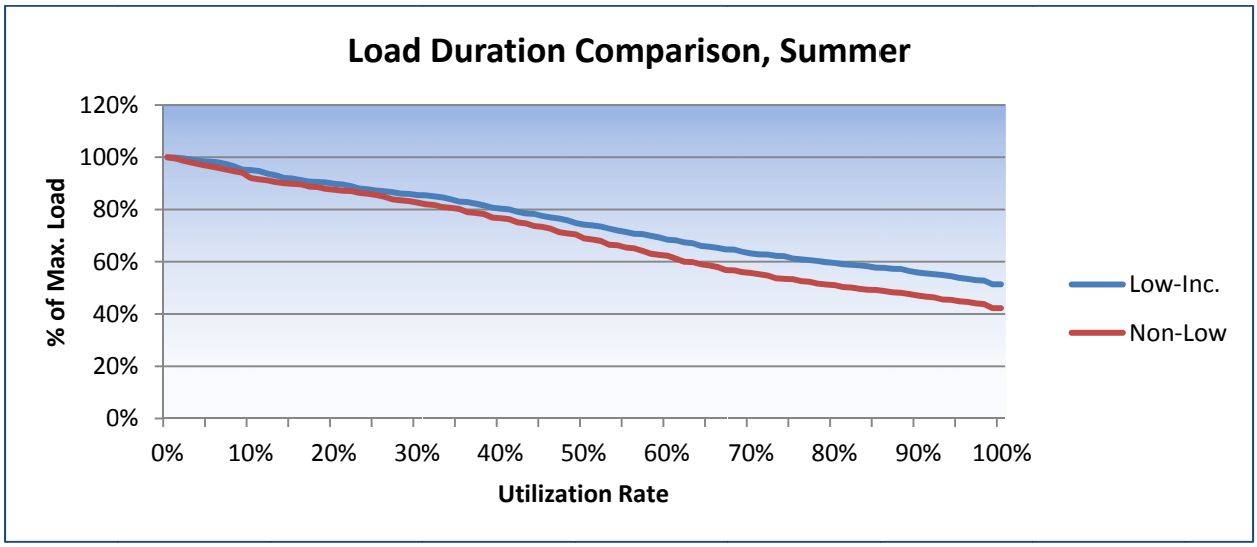


Comparing low-income "load duration" shows these customers also have flatter, or less peaky, usage than the rest of the sample. Figure 3 shows seasonal average load duration curves for these groups. (It compares customer load, as a percentage of peak, at a given proportion of time.) A shallower load duration curve indicates flatter load shape.

In both summer and winter of 2016, low-income customers exhibited flatter load shape. This is significant because our previous research found a correlation between flatter load shape and higher savings associated with real time pricing.

Figure 3





Recommendations

EDF and CUB call for continued research into income and usage. Given the urban skew of the current data, more research is needed into the relationship of income and usage, to better inform utility rate cases—particularly in instances when utilities try to increase fixed charges, which have a greater impact on people of limited income.

There are many important and interesting energy questions to examine, so EDF and CUB look forward to conducting more analysis. Please check back for further updates.