# Coalition - Book of Documents 3 – Prairie Research Associates Sources

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| 1 | Jonathan Teller-Elsberg, et al, "Fuel poverty, excess winter deaths, and energy costs in Vermont: Burdensome for whom?" (2016) 90 *Energy Policy* 81. https://doi.org/10.1016/j.enpol.2015.12.009 | MH Filing Appendix 10.5, *Manitoba Hydro Bill Affordability Collaborative Process: Summary Report & Recommendations,* Appendix A, Prairie Research Associates, "Bill Affordability Research Services: Final Report" at 61, 146. | **5** |
| 2 | Jerrold Oppenheim, "The United States regulatory compact and energy poverty", (2016) 18 *Energy Research & Social Science*, 96. https://doi.org/10.1016/j.erss.2016.04.022 | *Ibid* at 61, 144 | **19** |
| 3 | Excerpt from APPRISE. (2012). PECO Energy Universal Services Program Evaluation (Final Evaluation Report). Retrieved from http://www.puc.state.pa.us/general/pdf/USP_Evaluation-Peco.pdf | *Ibid* at 134, 178, 180, 185, 188 | **35** |
| 4 | Excerpt from PECO Energy. (2013, May 6). PECO Energy Company's Second Amended Universal Services Three-Year Plan (2013-2015). Retrieved from http://www.puc.state.pa.us/general/pdf/PECO_USP.pdf | *Ibid* at 113, 115-116, 144, 173-174, 178, 180, 185, 188. | **45** |
| 5 | Kenneth Green et al, *Energy Costs and Canadian Households: How Much Are We Spending?*, Fraser Institute, March 2016. | *Ibid* at 63, 139. | **65** |

# 1

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# Fuel poverty, excess winter deaths, and energy costs in Vermont: Burdensome for whom?

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## HIGHLIGHTS

- Those spending 10 percent of their monthly income or more on energy services are in "fuel poverty".
- In this study we analyze the energy burden in Vermont by household income deciles.
- We calculate that excess winter deaths caused potentially by fuel poverty kill more Vermonters each year than car crashes.
- We conclude with implications for energy planners and policymakers.

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## ABSTRACT

Energy, whether from electricity, natural gas, heating oil, propane, kerosene, or wood, is essential for the well-being of many Americans, yet those who spend more than 10 percent of their income of energy services can be considered "fuel poor." This study assesses the extent and severity of fuel poverty in Vermont. It analyzes energy burdens in Vermont by household income deciles, using data from the Census Bureau's American Community Survey. Approximately 71,000 people suffered from fuel poverty in Vermont in 2000, and in 2012 the number rose to 125,000, or one in five Vermonters. Startlingly, fuel poverty grew 76 percent during this period. Excess winter deaths, caused potentially by fuel poverty, kill more Vermonters each year than car crashes. The article then provides 12 policy recommendations based on a small sample of elite semi-structured research interviews. These include suggestions that the Vermont legislature better fund investments in weatherization among low-income households; that community groups and social service agencies scale up the training of energy efficiency coaches; that state agencies endorse improvements in housing efficiency and appropriate fuel switching; and that utilities and fuel providers offer extra assistance for disconnected households and allow for on-bill financing of efficiency improvements.



## 1. Introduction

In many ways, the green, small state of Vermont is known for being an innovative laboratory for progressive energy and climate policies.[1] Readers unfamiliar with Vermont may be surprised to learn that it was recognized for "sustained excellence" by the U.S. Environmental Protection Agency (EPA) for its contribution to the Energy Star efficiency program and that Harvard University named Efficiency Vermont one of the five best government programs in the United States. Vermont's electricity sector is the cleanest and least fossil fuel intensive in the nation. Vermont has also pursued one of the most proactive smart grid policies in the United States. The Vermont Electric Cooperative (VEC) exemplified this leadership by installing advanced meters in roughly ninety percent of homes by the end of 2011.

Yet such advances may have begun to come with certain costs, especially as they relate to the affordability of energy services for the poor and vulnerable. Energy, whether from electricity, natural gas, heating oil, propane, kerosene, or wood, is essential for the well-being of all Vermonters. We need it for warmth during much of the year, to cook our food, and to power the appliances in our

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[1] Sovacool et al., 2014.

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homes. More of us are coming to depend on air conditioning in the summer. Energy is essential not merely to a modern standard of life, but to physical and mental health. The expense required for the purchase of energy can be a significant burden, especially for those with relatively low incomes.

In this study, we investigate the extent and severity of fuel poverty in Vermont. We analyze energy burdens in Vermont by household income deciles, using data from the Census Bureau's American Community Survey. We find that approximately 125,000 Vermonters, or one in five, live in fuel poverty. We also calculate that approximately 72 percent of Vermonters in the lowest income decile suffer from fuel poverty. Alarmingly, fuel poverty grew 76 percent .from 2000 to 2012. The article then provides 12 policy recommendations based on a small sample of elite semi-structured research interviews.

To be sure, while we hope our study is of value to planners in Vermont and the rest of the United States, it also offers broader value beyond North America for three reasons. First, it hammers home the point that the affordability of energy services is not a function merely of price. For the same quantity of energy, rising prices impose a greater burden when incomes fail to rise as fast. In other words, what matters to users of energy is not the price, per se, but the size of the energy bill and how it compares to income. Though people with smaller incomes generally use less energy and have smaller bills in absolute terms, our study shows how they must spend a larger fraction of their income on this energy than households with greater income. This means that the financial burden for lower-income households is more severe even with reduced consumption of energy, a finding with clear implications for both energy affordability as well as energy justice.[2]

Second, our study reveals how one particular household energy security concern, affordable warmth, is also a significant public health issue. People who lack sufficient energy to keep warm in winter face serious, if sometimes subtle, health risks. For example, in a review of the research on the connection between fuel poverty and human health, Liddell and Morris[3] list risks including stroke, heart attack, pulmonary embolism, influenza, pneumonia, asthma, arthritis, depression, anxiety, and accidents within the home, which are presumed to result from reduced mobility and flexibility, especially for those with arthritis or similar conditions. Together, these health impacts result in an effect known in the public health community as "excess winter mortality." When homes are cold and damp, children appear more likely to miss school and to have respiratory problems.[4] In their review of US-based research regarding children 3 years old and younger, a vicious cycle for poor families in cold climates can occur: children require more calories to maintain healthy development if they are in cold conditions, yet poor families must balance food purchases against fuel purchases. Liddell and Morris lastly found that poor families reduced food intake by an average of 10 percent (measuring in terms of calories) during winter, shifting money toward heating fuels.[5] It is not surprising that another study comparing low-income households that did or did not receive winter fuel subsidies found that infants in households without the subsidies were less developmentally advanced, had lower weight-to-age measure, and faced an increased chance of requiring emergency medical care.[6] The elderly are another group at greater risk to fuel poverty, given that they are likely to be retired and/or on fixed incomes yet spend large periods of time in their homes where they wish to keep comfortable and have greater demands for winter warmth.[7,8] One study even found that to some older people, "heating is more important than food."[9]

Third and lastly, given these health concerns, this study shows how the co-benefits to investing in energy efficiency, especially among the poor, can become quite large. Over the years 1999–2011, Vermont averaged 172 excess winter mortalities per year.[10] This represented 3.3 percent of all deaths in that period, more than double the rate of deaths from automobile and other transportation accidents.[11] Our analysis does not allow us to definitively identify the causes of death, and therefore to fully attribute these excess winter mortalities to fuel poverty. Nonetheless, fuel poverty appears to be the most likely explanation for the consistent increase in wintertime death rates in Vermont. That means that eradicating fuel poverty produces huge savings in avoided mortality and morbidity, a potent reminder that low income energy efficiency programs can pay for themselves quite quickly, producing measurable benefits (which are not often or always monetized) that can far exceed costs.[12]

## 2. Definitions and research methods

This section of the paper defines fuel poverty and introduces the primary and secondary methods utilized in the study, namely a quantitative analysis of Census data to determine energy burdens and qualitative research interviews to determine policy recommendations.

### 2.1. Defining fuel poverty

Generally, those who spend more than 10 percent of their monthly income of energy services can be considered "fuel poor" or suffering from "fuel poverty." The World Health Organization defines minimum adequate warmth in the home as 21 °C (69.8 °F) in the main living space and 18 °C (64.4 °F) in other rooms.[13] Though readers may consider this a surprisingly warm standard, keep in mind that the standard must account for those who are most vulnerable, including young children, the elderly, and those with chronic or otherwise serious health conditions.

Different writers have adopted different methods to identify the fuel poverty threshold.[14] The earliest definition in the research literature set the fuel poverty threshold at twice the median—that is, if median expenditure is $X$ percent of household income, then households are in fuel poverty if they spend $2X$ percent or more of their income on household energy.[15] For reasons of analytical and explanatory simplicity, we adopt the definition of fuel poverty as occurring when more than 10 percent of income goes toward energy purchases.[16] In the UK, where significant research into fuel poverty has occurred, the twice-median measure has generally given similar results to the 10 percent measure, though they do sometimes diverge.[17]

Readers should be aware of another nuance in fuel poverty definitions. UK researcher Brenda Boardman's definition, in her landmark 1991 book *Fuel Poverty: From Cold Homes to Affordable Warmth*, focused on the amount that a household would "need to spend" to maintain acceptable conditions (specifically with regard

[2] Sovacool, 2013; Jones et al., 2015.
[3] Liddell and Morris, pp. 2988 and 2992.
[4] Liddell and Morris, pp. 2991–2992.
[5] Liddell and Morris, p. 2992.
[6] Liddell and Morris, p. 2992.
[7] Warriner, 1981.
[8] Wright, 2004.
[9] O'Neill et al., 2006.
[10] We define "winter" as December through March. Data from Centers from Disease Control.
[11] Centers for Disease Control.
[12] Sovacool, 2015.
[13] World Health Organization, 2007, p. 4.
[14] Liddell, et al., and Sovacool, p. 44.
[15] Liddell, et al., p. 27–28.
[16] Liddell, et al., p. 28, and Sovacool, p. 44.
[17] Liddell, et al., p. 28–29.

to warmth), acknowledging that actual spending might fall below this level.[18] Subsequent research in the UK found that a great many low-income households spent much less on energy than was required to keep their homes warm enough,[19] thus putting those residents at increased risk for the health impacts listed above. Due to limitations on available data, we use the simpler definition whereby the threshold is pegged at 10 percent of actual spending.

### 2.2. Calculating energy burdens

To calculate and estimate fuel poverty, we rely on the notion of an energy burden. Energy burden is defined as *expenditure on energy as a percentage of income*. There are three variables involved in ascertaining the energy burden: the quantity of energy consumed, the price of energy, and income. The two-step formula for determining the energy burden is

1) quantity of energy consumed × price of energy
= spending on energy

2) $\frac{\text{spending on energy}}{\text{income}}$ = energy burden

When energy burdens are significant, those enduring such burdens are said in the research literature to be in "fuel poverty."[20]

To map the prevalence of fuel poverty in Vermont, we relied on data from the Census Bureau's American Community Survey.[21] This survey provides data on household income as well as household expenditures for electricity, natural gas, and "other fuels," which includes heating oil, propane, kerosene, wood, coal, and coke. Our results, explored in detail below, show the energy burdens for each of those three energy categories as well as the sum of all expenditures for energy in the household.

Consequently, our analysis does have some limitations and caveats. It will not identify households as being in fuel poverty if the household fails to spend over 10 percent of its income on energy, even when that failure means that the household is maintained at unacceptably low temperatures. On the other hand, our analysis below will count households as being in fuel poverty even if the reason for their spending being above 10 percent of annual income is due to their maintaining their home at a higher temperature than is needed to sustain good health.[22] We believe that, while far from ideal, our definition provides useful information in identifying meaningful financial stress—or lack thereof—for Vermont households due to the cost of using energy.

Moreover, it is important to understand that fuel poverty can occur even when the household in question is not identified as otherwise being in poverty.[23] A family may have enough income to be above the poverty line, yet spend more than ten percent of its income on energy—these expenditures may be high enough that the family's ability to manage the rest of its financial needs is hampered, possibly significantly so. A study by Fisher, Sheehan, and Coltan found that, in 2012, Vermont households with income between 185 and 200 percent of the Federal poverty line spent, on average, 14 percent of their income on energy.[24] Our research, discussed in detail below, reveals that, in 2012, average energy burdens for the bottom three deciles of Vermont households were above the fuel poverty threshold; for the bottom decile, the average energy burden was a whopping 28 percent. Also, keep in mind that our analysis focuses exclusively on the financial burden of energy used within the household. Spending on transportation energy (i.e., gasoline and diesel) is excluded, though it certainly can impose a financial burden and would make for a valuable follow-up study.

### 2.3. Determining policy recommendations

Our secondary research tool involved elite semi-structured research interviews, conducted to acquire qualitative data about policy recommendations. These interviews were "elite" given that they involved a small sample of influential planners and policy-makers, meaning they are not representative of "ordinary" or "normal" people.[25] To best determine recommendations with the most achievable potential, the authors interviewed various stakeholders and inquired what each of these actors could do to address energy and fuel poverty in Vermont. These were semi-structured interviews in which each interviewee was asked four questions:

1. What could the state legislature do to address energy and fuel poverty in Vermont?
2. What could state agencies do to address energy and fuel poverty in Vermont?
3. What could community groups do to address energy and fuel poverty in Vermont?
4. What could energy companies do to address energy and fuel poverty in Vermont?

Eight of the interviews were conducted via telephone or Skype, in which interviewees did not have access to the questions beforehand. One interview was conducted via email, in which the interviewee had time to plan his/her answers.

In collecting data from these interviews, we spoke with representatives from the Regulatory Assistance Project (RAP), Vermont Fuel Dealers Association (VFDA), Capstone Community Action, Department of Public Service (DPS), Vermont Energy Investment Corporation (VEIC), Vermont Natural Resources Council (VNRC), Vermont Communities Foundation and High Meadows Fund (VCF), and Green Mountain Power (GMP).[26] The interviewees all recognized that an energy burden exists for many Vermont low-income households, as well as the need to proactively combat this trend. We present the data from these interviews below with direct attribution to the particular respondent.

As we will see in the second half of the paper, the data gleaned from these interviews suggests that there are many things these four primary sets of actors can do in advocating for low-income households to decrease energy burdens in Vermont.

## 3. Determining the extent of fuel poverty in Vermont

This part begins to present the study's results, first measuring the extent of fuel poverty in Vermont over time. The next section offers a suite of policy recommendations to combat it.

[18] Liddell, et al., p. 28.

[19] Boardman, 2012, p. 143.

[20] Though it might seem intuitive to use the term "energy poverty" instead of "fuel poverty," the term energy poverty is used to describe the condition in developing nations in which people lack physical access to modern energy sources and systems, while fuel poverty refers to the situation in which modern energy sources are technically available but too costly—due to some combination of price, inefficiency in utilization, and income—for reasonable use. Some researchers use "energy insecurity" or "lacking affordable warmth" as synonyms for fuel poverty.

[21] Income and spending data are from Census Bureau, American Community Survey. Energy prices are from Energy Information Agency and Vermont Department of Public Service.

[22] Similarly, our analysis cannot weed out other discretionary, expensive uses of energy, such as those with indoor marijuana growing operations.

[23] Sovacool, p. 46.

[24] Fisher, Sheehan, and Coltan.

[25] Dexter, 1970; Richards, 1996; Woods, 1998.

[26] The interviewees are named in the Acknowledgments section at the beginning of this report.

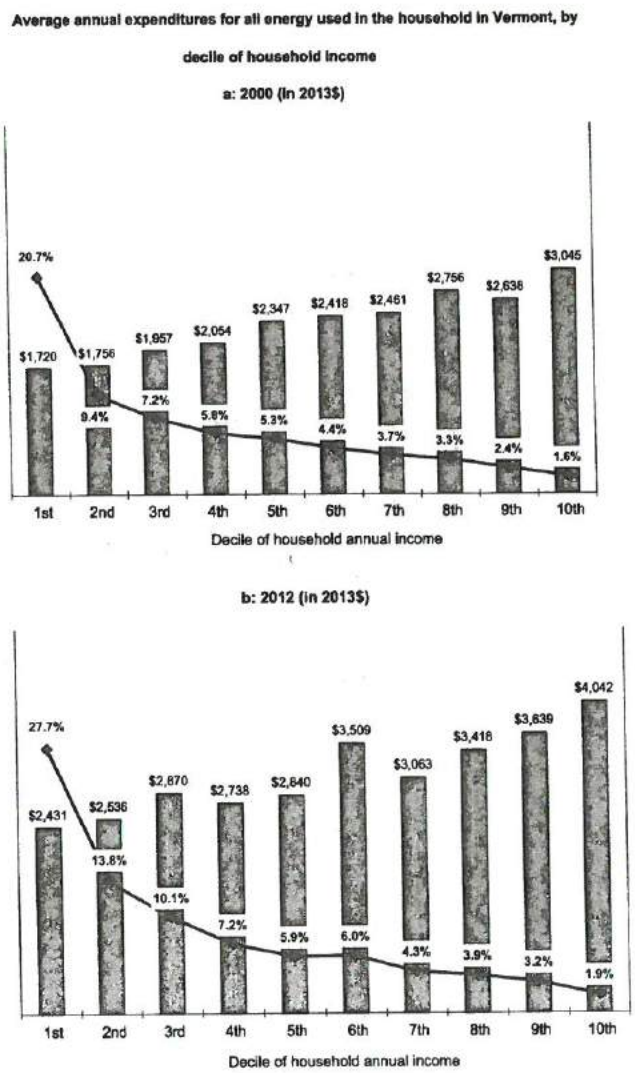


**Fig. 1.** Average annual expenditures for all energy used in the household in Vermont, by decile of household income.

In the first part of this study we analyze the energy burden in Vermont by household income deciles.[27] Fig. 1 shows snapshots of the energy burden in the years 2000 and 2012, respectively. The vertical bars show the average dollar amount spent by households within each decile on all energy used in the household. Throughout this study, all monetary values have been adjusted for inflation and are displayed in "real" 2013 dollars.[28] The red lines show how much of a burden those expenditures are, measured as a percentage of the average household income within each decile.

Due to limitations in the data, these results likely understate energy burdens. Many renters have some or all of their energy costs included in their rent, and therefore show little or no energy expenditure in the survey. As a result, when calculating energy expenditures as a percentage of income, these households likely return misleadingly low values.[29]

That said, a few patterns are visible in both years. Though not strictly so, there is a clear tendency for households with more income to spend more money on energy. Despite lower absolute levels of expenditure on energy by households in lower deciles, these purchases take up a greater fraction of their income. The energy burden is quite low for the top decile. Moving to the left, the increase in burden on each lower decile is at first fairly modest, then rises rapidly for the lowest deciles.

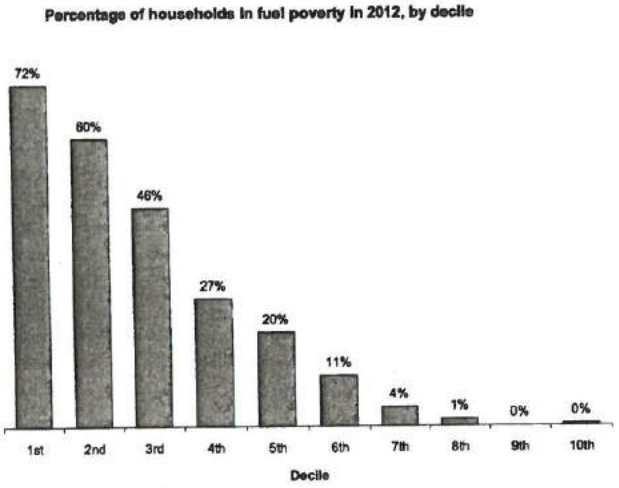


**Fig. 2.** Percentage of households in fuel poverty in 2012, by decile.

As is apparent, the burden in 2012 was greater than in 2000: a greater average quantity of (inflation-adjusted) money was spent on energy by households in each decile, and this quantity was a greater percentage of average household income for each decile. If incomes had grown faster than energy expenditures, then the cost burden would have fallen despite the growing expenditures. Clearly, this has not been the case. Growth in energy expenditures outstripped growth in income.

In 2000, only the lowest-income decile had, on average, an energy burden sufficient to qualify as fuel poverty. Recall that these values are averages for the deciles, so it is possible for some households in the lowest decile *not* to be in fuel poverty, per se, despite their low incomes—and indeed there were such households. In turn, given that the average burden for the second decile was only slightly below the fuel poverty threshold at 9.5%, a large portion of households in the second decile were in fuel poverty. In fact, even the 6th and 7th deciles included nontrivial fractions of households experiencing fuel poverty in 2012, as is seen in Fig. 2. To be sure, the impact of a high energy burden on a relatively high-income household is unlikely to be as extreme as on a low-income household. Fuel poverty by itself is an incomplete measure of financial strain.

The statistics indicated above are also a reminder that fuel poverty only partly correlates to financial poverty—not all of Vermont's poorest households are in fuel poverty, and more than a few households with income well above the "poverty line" nonetheless experience fuel poverty. In 2012, the official US poverty line for a family of four, including two children, was $23,624 (inflation-adjusted to 2013$ value).[30] As seen in Table 1, this is approximately the threshold between the 2nd and 3rd deciles. Yet even in the 5th decile, where average incomes are roughly double the poverty line, one in five households was experiencing fuel poverty in 2012.[31]

[27] A "decile" is 10 percent of the population—in this case, counted as households, and ordered from lowest to highest by annual income.

[28] Inflation adjustment was made using the CPI-U index from Bureau of Labor Statistics.

[29] Additional, and more sophisticated, analysis in the future may allow us to correct for this factor.

[30] Census Bureau, "Poverty Data – Poverty thresholds."

[31] It is worth noting that the method for determining the official US poverty line has been heavily criticized for many years. For example, see Blank. That said, this paper is not the place to analyze that debate.

**Table 1**
Household income decile thresholds.

| Income decile | 2000 | 2012 |
|---|---|---|
| 10th | $121,824 and higher | $133,933 and higher |
| 9th | below $121,824 | below $133,933 |
| 8th | below $94,698 | below $98,421 |
| 7th | below $72,674 | below $78,757 |
| 6th | below $60,877 | below $64,937 |
| 5th | below $50,731 | below $53,168 |
| 4th | below $39,638 | below $42,980 |
| 3rd | below $31,453 | below $33,078 |
| 2nd | below $22,741 | below $23,844 |
| 1st | below $13,501 | below $14,205 |
| Official US poverty line in 2012 (family of four including two children) | | $23,624 |

Note: To be in decile, household must have real income.

**Table 2**
Percent of renter households in each decile in 2012.

| Income decile | Renters | Average |
|---|---|---|
| 10th | 4.2% | 14.8% |
| 9th | 10.8% | |
| 8th | 11.3% | |
| 7th | 27.4% | |
| 6th | 20.5% | |
| 5th | 33.7% | 39.7% |
| 4th | 34.5% | |
| 3rd | 35.6% | |
| 2nd | 48.0% | |
| 1st | 46.4% | |

For the lower deciles in general, one possible contributing factor is that these households are less likely to be able to afford efficiency upgrades to their homes, which generally require significant up-front expense. This is exacerbated by rising energy burdens on lower-income households, leaving them less discretionary money with which to make investments in efficiency. Further exacerbating the situation is the fact that lower-income households are more likely to be renters, and therefore have less ability to implement efficiency improvements even if they desire and can afford to do so. Table 2 shows rates of rented housing in 2012. We speculate a further exacerbating factor for renters, that landlords providing rental housing to lower-income households are less likely than landlords providing housing to higher-income households to be interested in investing in energy efficiency improvements to their properties.

The impact of rising prices is aggravated by more-or-less stagnant household incomes for all but the top decile. Table 3 shows average annual rates of change in household incomes by decile.

Fig. 3 shows changes in real prices for the most common energy sources from 2000 to 2012. Note that Fig. 3 does not suggest that natural gas has a similar price to propane or heating oil, or that electricity has a similar price to wood; instead, it shows that—relative to their prices at the beginning of the study period, the prices of the three fossil fuels have risen in a similar fashion, while the prices of electricity and wood have held relatively stable.

Two things are clear. First, electricity prices have risen much more slowly than prices for the fossil fuels commonly used for home heating (and, in the case of propane and natural gas, cooking).[32] Second, those fossil fuels have, on average, risen in price far faster than incomes have risen for any of the deciles. Electricity has risen in price more slowly than the average increase in household income for the upper seven deciles. Income gains by the lowest three deciles have been only just sufficient or slightly insufficient to keep pace even with the low rate of increase in real electricity prices.

**Table 3**
Changes to average real household income, 2000–2012.

| Income decile | Average annual change in real income[a] | Change as % of average annual real income[b] |
|---|---|---|
| 10th | $2,372 | 1.2% |
| 9th | $445 | 0.4% |
| 8th | $337 | 0.4% |
| 7th | $348 | 0.5% |
| 6th | $281 | 0.5% |
| 5th | $303 | 0.6% |
| 4th | $202 | 0.5% |
| 3rd | $123 | 0.4% |
| 2nd | ($20) | (0.1%) |
| 1st | $40 | 0.4% |

[a] The second column was calculated by measuring the change from each year relative to the prior year, and then averaging the results. Values are in 2013 dollars.
[b] The third column was calculated by dividing the result in the second column by the average of annual real income in the decile for all the years covered.

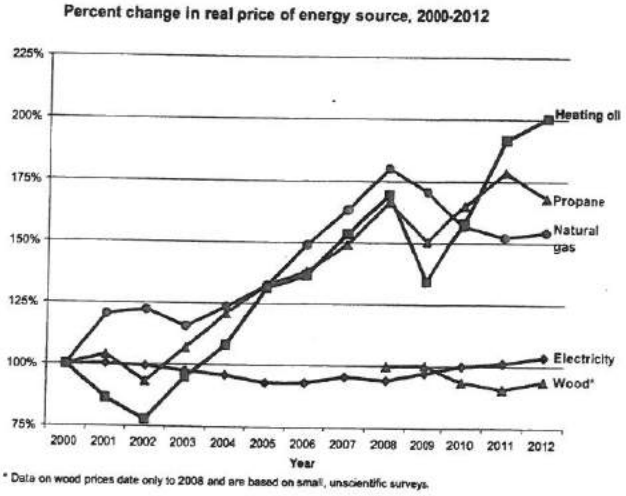


**Fig. 3.** Percent change in real price of energy source, 2000–2012.

Perhaps not surprisingly, there has been a shift in fuels used for heating. The primary changes have been a reduction in reliance on heating oil and an increase in reliance on wood, as shown in Fig. 4. The percentage of Vermont households relying on heating oil as their primary source of heat has fallen from 61 percent in 2000 to 46 percent in 2012. The percentage of households relying on wood has increased from 9 percent in 2000 to 18 percent in 2012.[33]

Households from different deciles have pursued fuel switching to different degrees. As seen in Fig. 5, those with more income have, in general, switched out of oil and into wood to a greater extent than those with less income.

Fig. 6 shows the trends in energy cost burden in Vermont from 2000 to 2012. These trends are displayed in terms of *income remaining after spending on the energy category*. Visually, the greater the proportion of income spent by a household on energy, the lower the household will appear in the figure. A household

[32] As of 2012, wood was the second most common fuel for home heating. However, there are very limited statistics on wood prices, so we are unable to analyze and compare how those prices have changed over the study period.

[33] Note that this represents only the *primary* heating fuel. For example, a household switching from oil to wood for primary heating fuel does not necessarily cease to use oil, and may rely on wood only slightly more than on oil.

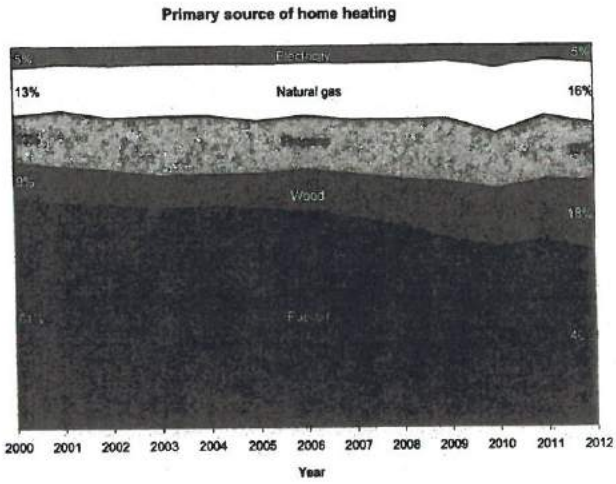


**Fig. 4.** Primary source of home heating.

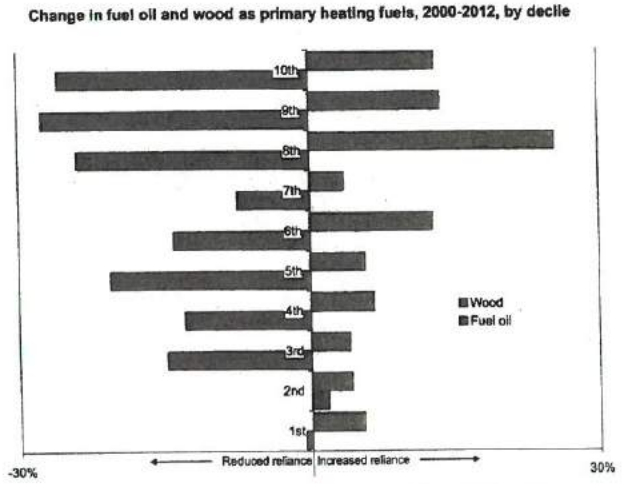


**Fig. 5.** Change in fuel oil and wood as primary heating fuels, 2000–2012, by decile.

spending more than 10 percent of income on energy has crossed the fuel poverty threshold, highlighted in the figures by the gray shading. Each figure covers a different energy category: electricity, natural gas, other energy (heating oil, propane, kerosene, wood, etc.), and all household energy combined. Energy consumed for transportation is excluded.[34] In Fig. 6a–d, each dot represents the average for an income decile in a particular year. The lines show trends for the deciles.[35] The five lowest-income deciles are shown individually. Because the upper deciles all fall below a 5 percent energy burden in each measure, the 6th through 10th deciles are shown combined, to avoid unnecessary visual clutter.

Again, three patterns are clear: (1) each higher-income decile experienced a smaller cost burden for energy expenditures as compared to lower-income deciles, (2) each higher-income decile experienced a flatter trend in the change of cost burdens over the time period studied as compared to lower-income deciles, and (3) there is less variation in burden from year to year for each higher-income decile as compared to lower-income deciles.

Interestingly, the cost burden of electricity has actually fallen—

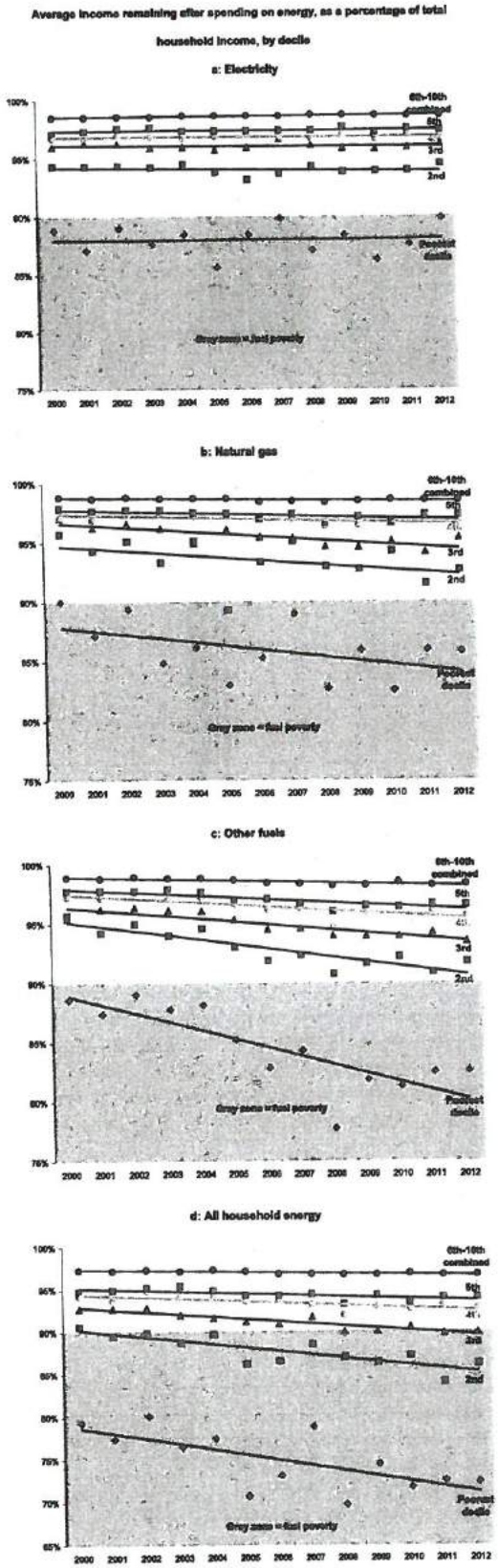


**Fig. 6.** Average income remaining after spending on energy, as a percentage of total household income, by decile.

[34] Households using plug-in electric vehicles are theoretically included, but there were so few such vehicles in Vermont in the study period that they can be safely ignored.

[35] Specifically, these are linear (ordinary least squares) regressions.

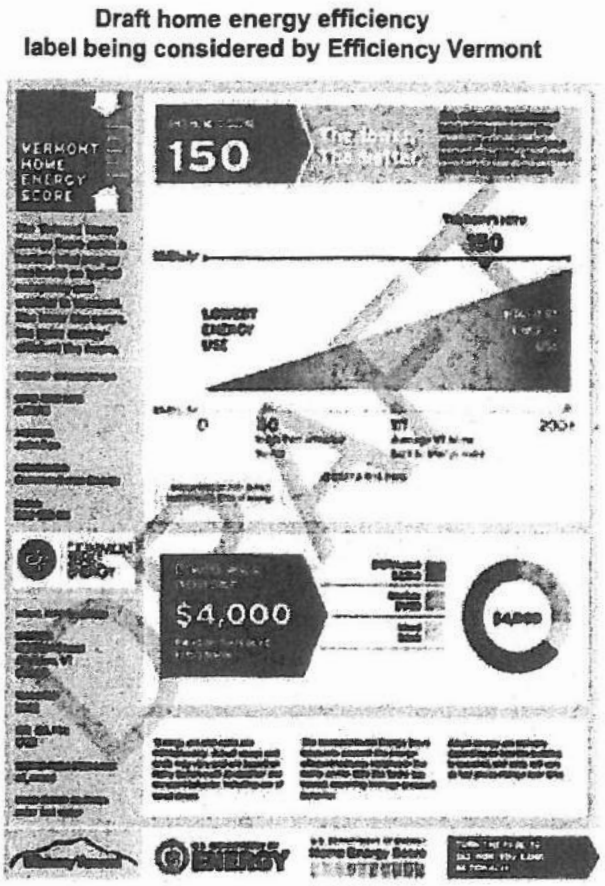


**Fig. 7.** Draft home energy efficiency label being considered by Efficiency Vermont.

though only very slightly—for most deciles. For the other categories of energy consumption, the trends for the upper-income deciles show very shallow increases in burden (reductions in post-energy disposable income).

As can be seen, the lowest decile experiences a significantly greater cost burden than other deciles for each energy category. In fact, spending for any one category of energy alone is enough to push the 1st decile well into fuel poverty. Though the burdens shown in Fig. 7d for "all energy" are not a simple summation of the burdens from the other three, the combined effect of purchasing multiple forms of energy is to push low-income households into an extreme degree of fuel poverty.

Also apparent are the differences in trends for different energy categories. The trend for electricity is effectively flat, for natural gas it is clearly down-sloping, and for other fuels it is more steeply downward. When analyzed together as all energy, the cumulative effect is a trend that is steeper than for any of the individual energy categories.

One other clear finding from our results is that fossil fuels in the household are the energy sources imposing the greatest burdens, and the most rapidly growing burdens. To date, Vermonters' have had only modest luck in reducing use of these fuels outside of fuel switching, where some fuel switching is between one fossil fuel and another. Since their prices are largely unregulated (natural gas is the exception[36], and the state's taxing authority affects heating oil and propane prices at the margins), and since the most important financial impact on households comes in the form of the bill, conservation and efficiency are the main strategies available to reduce fuel poverty. Care must be taken with conservation, since poor households aren't done any favors when, for example, they set their thermostats below healthy temperatures. That leaves efficiency as the most important strategy to pursue, along with measures to increase household incomes. Fuel poverty expert Brenda Boardman writes, "We have learnt a lot about what fuel poverty is and is not, since the mid-1970s when the term first came into use.... [w]hile fuel prices and low incomes are constituent factors, the real cause of fuel poverty is the energy inefficiency of the home."[37]

Boardman's conclusion is based largely on research conducted in the UK and Ireland, where homes are frequently old and constructed with solid masonry walls providing little insulation value, and therefore does not apply in full to Vermont. However, like those countries, Vermont has a relatively old housing stock, making comparisons useful. As is noted below, some Vermonters with an inside perspective on fuel poverty put a stronger emphasis on poverty in general as the principal issue behind fuel poverty. Specific ideas for addressing energy burdens and fuel poverty in Vermont are listed in the Twelve Policy Recommendations section to come.

## 4. Policy recommendations for addressing fuel poverty

This section of the study presents twelve policy recommendations on fundamental ways to decrease the energy burden for Vermont low-income households, organized by each of four primary sets of actors. This data comes from our secondary method of semi-structured elite research interviews, described above.

### 4.1. The Vermont legislature

Our interview data suggests three recommendations for the Vermont legislature:

1. Increase funding for low-income weatherization;
2. Continue supplementing federal programs; and
3. Mandate energy efficiency labeling for homes.

As Hal Cohen from Capstone Community Action explained, "What's the biggest hurdle to alleviating fuel poverty in Vermont? The answer is simple: it's a shortfall of funds."[38] To counter this shortfall, we recommend first that the legislature increase support for the low-income Weatherization Assistance Program (WAP) by expanding the Fuel Gross Receipts Tax.[39] "For every $1 invested, the program returns about $2.51 to the household and society, including $1.80 in reduced energy bills and $0.71 in non-energy benefits (e.g., increased local employment and improved housing quality)" and better health and safety.[40]

Weatherization and efficiency measures are a tried and true solution to reducing energy bills, improving quality of life in the home, or both. Across the United States, the average household receiving weatherization through WAP has first-year energy

[36] Keep in mind that, with limited exceptions, the state cannot regulate prices so strictly that it prevents the suppliers from being able to garner a fair return on investment. Thus when wholesale prices rise, regulations must (more or less) allow the regulated gas utility to recover costs.

[37] Boardman, p. 143.

[38] Semi-structured research interview with the research team, July 14 2014.

[39] All deliveries of kerosene, heating oil, and other dyed diesel fuels to customers' residential or business locations are subject to the fuel gross receipts tax.

[40] Vermont Department for Children and Families, p. 38.

savings of $466.48.[41] Assuming that value for Vermonters, providing WAP to all eligible households would reduce the number of households in fuel poverty by approximately 19 percent.

In Vermont, the low-income housing stock tends to be older and less efficient than housing available to higher-income households. Currently, the Fuel Gross Receipts Tax is low, generating only about 0.5 percent of all revenues raised. Gradually raising this tax to 2 percent or greater would provide an important increase in money available for WAP.

Our second recommendation is that the legislature continue supplementing the Federal Low Income Home Energy Assistance Program (LIHEAP). Although weatherization and efficiency should be primary measures, they cannot reach everyone in the time needed to ensure all Vermonters are warm in the frigid winter months of the next few years. Capstone Community Action informs us that it has a waiting list of 18 months for people wanting to get weatherization assistance. Low-income assistance must remain available as a safety net. Funding from the state for the program may be an opportunity to design programs that can use the funding more efficiently and reach more Vermonters, with their tax dollars ideally going further than the federal money could.

Third, we recommend that the legislature mandate energy efficiency labels in housing. The legislature did set up a working group on energy disclosure. The working group concluded with a vote of 12-0 "to support a requirement that property sellers provide a disclosure of building energy performance, delivered through a mechanism such as an online tool with no cost to the end user, and tracked through a database of a form to be determined," with two abstentions and two absences.[42] We agree with the working group that, for any disclosure tool required of sellers, "that tool should have no cost to the end user," and that for "any buyer tool requirement… costs for such a tool would need to be subsidized" for low-income users.[43] The next step is for the legislature to recognize and incorporate one labeling scheme in order to set minimum standards across all of Vermont's housing stock. One draft for how this labeling scheme could work is shown in Fig. 7.

### 4.2. Community groups and social service agencies

Our data suggests that community groups and social service agencies:

1. Provideand prioritize energy efficiency audits and coaching;
2. Distribute energy conservation and efficiency materials; and
3. Ramp up educational awareness and outreach programs.

First, Vermont needs more energy efficiency coaches, people who are trained in low-income outreach, energy efficiency strategies, and community-based social marketing concepts. This is currently taking place within Vermont's Sustainable Energy Resources for Consumers program.[44] Other Vermont groups can adopt and expand on the concept. The benefit of this program is that it is a more rigorous approach to weatherization, helping clients every step of the way to make sure that not only are efficiency technologies installed, but that they are enhanced by proper guidance and behavior change to ensure that efficiency is actually achieved.

Second, we believe that social service agencies and health clinics serving lower-income populations should be utilized as points of distribution for energy conservation and efficiency materials. Materials that would otherwise require payment by the low-income recipient should be subsidized to the extent possible. These materials might be offered individually or in kits, which need not cost more than $50 to $150 each, and could include:

- CFL or LED light bulbs,
- low-energy night lights,
- window plastic kits,
- hot water temperature gauges,
- faucet aerators,
- refrigerator thermometers,
- information on WAP, and
- information for owner-occupied and rental-property efficiency improvement programs and subsidies.

These materials should come with pamphlets describing the savings that can be achieved through energy conservation and efficiency, explanations for how to effectively use the materials, and other tips for safely reducing energy consumption. In addition to the direct efficiency benefits they provide, they can also serve as a first-step introduction to weatherization, and a great tool for advertising various Vermont energy programs. If people have a positive experience with efficiency, they are more likely to do it again or change other behaviors.

Third and lastly, educational programs need to be refined and likely scaled up. As Richard Sedano from RAP told us, "due to a mix of social stigma and lack of knowledge, it's unclear whether those most in need of energy assistance are getting access to it here in Vermont."[45] Robert Dostis from GMP adds that "many Vermonters are not aware of the availability of existing assistance programs or they are reluctant to take advantage of them."[46] Community groups should understand the importance of fuel poverty and connect Vermonters with resources. A good way to position low income energy-efficiency policies is to re-cast low income weatherization in a light that is less stigmatizing, as many who are in fuel poverty do not see themselves as in "poverty" and will not seek out or accept assistance.[47] Personal success stories are a great way to build trust and confidence that these programs, whether assistance, efficiency, or weatherization, are worthwhile. As Riley Allen from RAP explains, "Community action is a vital element for overcoming fuel poverty here…. We need a mechanism for raising awareness and connecting customers to potential service providers and making the public aware of the support mechanisms that exist." [48]

### 4.3. Other state agencies

Our respondents stated that Vermont's government agencies can help address fuel poverty and energy burdens by directly or indirectly supporting residential efficiency efforts and energy affordability through appropriate fuel switching. As Johanna Miller, VNRC's Energy Program Director, noted, these agencies "need to be [sufficiently] funded and have a trained and educated workforce to help reduce consumption and make energy savings."[49] We therefore have three recommendations for state agencies other

[41] Eisenberg, p. v. The value has been inflation adjusted from the original (2010) to 2013 value.
[42] Working Group on Building Energy Disclosure, p. 3.
[43] Working Group on Building Energy Disclosure, p. 23.
[44] Department of Energy, Office of Energy Efficiency and Renewable Energy, "Sustainable Energy Resources for Consumers (SERC) Vermont Highlight."
[45] Semi-structured research interview with the research team, July 8 2014.
[46] Semi-structured research interview with the research team, July 7 2014.
[47] Heffner and Campbell, 2011.
[48] Semi-structured research interview with the research team, July 11 2014.
[49] Semi-structured research interview with the research team, July 10 2014.

than those directly providing social services:

1. Train staff in energy efficiency;
2. Focus on improvements to multi-family housing; and
3. Incentivize appropriate fuel switching, cold climate heat pumps, and heat pump water heaters

First, agency staff across the entire Vermont government should receive basic training in the value of energy efficiency and in the existence of leading energy programs in the state. Vermont's government employees not only communicate with a large fraction of the state's residents in any given year, they are themselves residents and from a social science perspective represent "nodes" in the social network. Concerns regarding energy affordability are liable to crop up in communication that agency employees have with residents, even when the ostensible subject seems unrelated, such as regarding permitting of various activities. Simple awareness of energy concerns and of the existence of programs to address them—from Weatherization Assistance to Efficiency Vermont rebates—enables agency staff from all Vermont agencies to act as conduits for sharing useful information.

Second, relevant agencies should focus on multi-family housing units for weatherization programs, especially those that serve low-income renters. Rental properties are prone to the problem of "split incentives," which occur when one party (the property owner) is responsible for the cost of an energy efficiency upgrade, but another party (the renter) will reap the energy savings benefit. Programs can confront split incentives by providing rebates or incentives that cover the incremental cost of more energy-efficient upgrades and equipment. Efficiency Vermont has programs in place to support energy efficiency improvements to rental properties.[50]

Promoting rental property improvements and transparency regarding energy costs is tricky but necessary to address Vermont's widespread fuel poverty and significant energy burdens. Vermont's government agencies can utilize carrots (such as direct or indirect assistance to rental property owners) and sticks (such as legal requirements for energy use reporting or building efficiency standards). Some of these efforts may be within existing regulatory powers, while others will require legislative authorization.

State agencies that deal with rental property owners can, at the very least, promote utilization of Efficiency Vermont's existing programs whenever communicating with rental property owners. Regarding rental housing, relevant agencies could span those related to economic development and the environment (such as the Agency of Commerce and Community Development, Agency of Natural Resources, or Natural Resources Board) to those dealing with social justice, empowerment, and human rights (such as the Vermont Commission on Women, Vermont Human Rights Commission, or Vermont Office of Veterans Affairs). Though not always state agencies, municipalities, the Vermont Apartment Owners Association, real estate agents, Vermont Center for Independent Living, and Vermont Legal Aid can also play supportive roles.

Thirdly, Vermont's agencies should consider when and how they might support households in switching to wood, natural gas, or—especially—electricity in the form of heat pumps. [51] At current energy prices in Vermont, heat pumps deliver heat at a lower cost than most other alternatives; unvented natural gas room heaters and (cord) wood stoves operate at slightly lower cost (assuming wood is purchased),[52] though each of these types of heating entails small risks of carbon monoxide or other negative health impacts. If natural gas and electricity prices continue their general trends, cold climate heat pumps will be more affordable to operate in the near term. At current prices, wood pellets and natural gas utilized in vented room heaters or central boilers or furnaces are slightly more expensive to operate than heat pumps, though still significantly less expensive than systems fueled by propane or heating oil.

Regarding fuel switching, relevant agencies may include, but are not necessarily limited to:

- Agency of Agriculture, Food, and Markets;
- Agency of Commerce and Community Development;
- Agency of Natural Resources;
- Department of Public Safety;
- Department of Public Service;
- Natural Resources Board;
- Public Service Board;
- Vermont Commission on Women;
- Vermont Economic Development Authority;
- Vermont Housing and Conservation Board;
- Vermont Office of Veterans Affairs;
- Vermont State Housing Authority; and
- municipal housing authorities.

To offer some guidance to these agencies, Efficiency Vermont already provides rebates for heat pump water heaters, a program worth continuing. A recent improvement to the current Vermont statute, Section 1. 30 V.S.A. § 209, may enable Efficiency Vermont funding to be used to promote cold climate heat pumps as well. This statute, through S. 202, signed into law on June 11th, 2014, has been amended to bring in the possibility of using the electricity efficiency charge to cover thermal efficiency achieved with heat pumps. The Public Service Board may authorize the use of funds raised through an energy efficiency charge on electric ratepayers to reduce the use of fossil fuels for space heating by supporting electric technologies that may increase electric consumption, such as (cold climate) air source or geothermal heat pumps. As seen in Fig. 5 above, approximately 5 percent of Vermont households currently use electricity as their primary heating fuel, and it is likely that most of those are using less-efficient and therefore more costly resistance electric heating. For many Vermonters, there is great savings potential in switching to electric space and water heating, when the heat is provided through heat pumps. The relatively high up-front cost of the technology can be lessened by a rebate or subsidy from state agencies. Despite the high upfront cost, the payback on the installations is short, owing to the fact that they greatly reduce heating bills. Energy savings may be felt across the state from switching to space heating with heat pumps: even if the market penetration is only at 10 percent, Vermonters could save $15 million annually in reduced fuel costs; at 50 percent market penetration the estimate is $85 million in energy bill savings.[53] The efficiency of heat pumps, in combination with Vermont's relatively low-carbon electric supply, has the added benefit of reducing greenhouse gas emissions when replacing

[50] Information on Efficiency Vermont's rental property programs is available at https://efficiencyvermont.com/For-My-Business/Solutions-For/Residential-Rental-Properties.

[51] Information on cold climate heat pumps and heat pump water heaters is available through Efficiency Vermont at, respectively, https://efficiencyvermont.com/For-My-Home/ways-to-save-and-rebates/Audits-Heating-Insulation/Cold-Climate-Heat-Pumps/Overview and https://efficiencyvermont.com/For-My-Home/ways-to-save-and-rebates/Appliances/Heat-Pump-Water-Heater/Overview.

[52] Energy Information Administration, "Heating Fuel Comparison Calculator," with prices adjusted to represent recent Vermont prices (as of July 2014). The calculator incorporates typical system efficiencies to estimate the cost of delivered heat from each fuel source.

[53] Letendre et al., 2014, p. 6.

fossil heating fuels.[54] State agencies can improve marketing and outreach to convey all of these benefits to Vermont consumers.

Efficiency Vermont currently offers rebates for central wood pellet boilers and furnaces.[55] The Air Quality and Climate Division within the Agency of Natural Resources also maintains an outdoor wood boiler change-out program.[56] This program was created primarily to address concerns over air pollution from older outdoor wood boilers, and its incentives may be applied toward replacement equipment, such as propane fired furnaces or boilers, whose operation may increase spending on fuel. The program's administrator should be encouraged to keep up to date on the relative operating costs of equipment supported by the program, so that s/he may advise applicants accordingly.

Vermont has in the past offered incentives to replace older, less-efficient wood stoves with EPA-certified alternatives, a program also administered by the Air Quality and Climate Division. The financial gains to be had from the efficiency these change-outs provide are modest, but sufficient to warrant the state considering offering the program again. (Admittedly, this would require legislation, and so is somewhat beyond the scope of agency discretion.)

In the part of Vermont that has natural gas service, agencies should consider promoting its use by eligible residences not currently doing so, though as indicated above this is likely to be less effective than adoption of cold climate heat pumps for reducing energy burdens in all but the short term.

### 4.4. Vermont utilities and fuel providers

Our final three recommendations derived from the interview data are for utilities and fuel providers. We recommend that these private sector stakeholders:

1. Provide extra assistance for those about to be disconnected;
2. Utilize on-bill financing or PACE for efficiency improvements; and
3. With regard to fuel dealers, diversify into energy services companies.

First, we recommend that Vermont utilities and fuel providers set up an arrangement for customers to be put in contact with social service agencies whenever the customers are about to be disconnected or no longer supplied with fuel, other than due to switching to a competing fuel provider. With electricity in particular, the coming smart grid will likely make these disconnections increasingly automatic and impersonal. It would be beneficial for households facing disconnection to receive assistance from social service agencies. No Vermonter should be disconnected without knowing what other options and safety nets are out there to help them. Customer service representatives at Vermont energy companies could be trained in directing customers to assistance programs once they see a pattern in unpaid bills and before they send out disconnection notices.

Second, we strongly suggest that these companies consider utilizing on-bill financing for efficiency improvements, whether or not the financing is provided by the companies themselves. From improved boilers to thermal efficiency, these improvements can be paid as part of the monthly billing scheme. Although on-bill financing programs are relatively new, there is a growing body of evidence indicating these programs are both effective and inclusive.[57] On-bill financing also allows efficiency improvements to become a more affordable option for Vermont households. Because on-bill financing does not create traditional consumer debt, it has the potential to overcome most of the first-cost related barriers to investing in energy efficiency upgrades and it can reach a majority of Vermonters, including low-income homeowners as well as landlords. Perhaps most importantly, on-bill tariffed financing allows all utility customers—including those who do not qualify for traditional loans—to install energy efficiency upgrades with no upfront payments and no personal debt obligation.[58] On-bill financing can be used for the purchase of infrastructure or capital improvements that will remain with the house or apartment. In California, a Financing Initiative for Renewable and Solar Technology (FIRST) program in Berkeley allows financing for efficiency upgrades or investments in renewable energy to be paid back through a line item on the property tax bill.

Vermont already offers a similar program through Property Assessed Clean Energy (PACE).[59] PACE programs enable local governments and state governments to fund the up-front capital expense of energy improvements and retrofits on commercial and residential properties, which are then paid back by the property owners over time, usually 10–20 years.[60] This empowers property owners to implement upgrades or investments without an initial large outlay of cash, meaning it addresses two significant barriers to energy efficiency commitments at the local level: lack of capital, and hesitancy to make investments in properties they may rent out or not own for a long period of time.[61] (The PACE investment stays with the property rather than the owner or investor). Some of the more established programs such as Sonoma County's Energy Independence Program and Boulder County's Climate Smart Loan Program have so far raised millions of dollars' worth of efficiency improvements. Although far from a panacea, even some critics concede that PACE "is a creative new method of financing renewable energy systems and energy efficiency improvements for residential buildings."[62] In sum, there are advantages in offering financing through the utility bill rather as well as through property taxes.

Third, we propose that company managers accelerate the transition of traditional fuel dealers into energy service companies. These energy service companies could become capable of profitably providing valuable efficiency improvements to their customers. The Efficiency Excellence Network, a collaboration between the Vermont Fuel Dealers Association and Efficiency Vermont, is off to a great start.[63] A number of fuel dealers are participating in this pilot program. They have already made available $6.5 million dollars for loans and they are planning to market themselves to customers as "energy service providers," not just fuel dealers. They could transition into a more holistic

[54] The greenhouse gas emission impact of wood is hotly debated by researchers, with many complex factors, such as the time scale and method of harvest considered, affecting the results. Depending on the analysis utilized, electrically powered heat pumps may result in fewer or more GHG emissions than wood.

[55] For information, see https://www.efficiencyvermont.com/For-My-Business/Ways-To-Save-and-Rebate/Heating-Ventilation-Air-Conditioning-(HVAC)/single-item/index/central-wood-pellet-boilers-and-furnaces.

[56] For information, see http://www.anr.state.vt.us/air/htm/OWBchangeoutprogram.htm.

[57] See, e.g., Sonja Persram, *Property Assessed Payments for Energy Retrofits*, David Suzuki Foundation, 31 (Mar. 2011), http://www.davidsuzuki.org/publications/downloads/2011/.Property%20Assessed %20Payments%20for%20Energy%20Retrofits.pdf

[58] Marianne Tyrell Colin Hagan, Rebecca Wigg, *Financing Energy Efficiency in Vermont*.

[59] For information on PACE, see https://www.efficiencyvermont.com/For-My-Home/Financing/Financing/PACE-Overview.

[60] U.S. Department of Energy, 2015.

[61] National Renewable Energy Laboratory, 2010.

[62] Cox, 2011, p. 83.

[63] For more information on the Efficiency Excellence Network, see https://www.efficiencyvermont.com/For-My-Home/ways-to-save-and-rebates/Audits-Heating-Insulation/Find-A-Contractor/een.

business wherein they also help their customers get more efficient boilers, solar hot water and heat pumps. To the extent that fuel dealers adopt the recommendation above to provide on-bill financing for these products and related services, they increase their value to customers and enhance this transition into energy services providers.

## 5. Conclusion and implications

Despite being a comparatively wealthy and small state known for its progressive, low-carbon innovations in electricity, energy efficiency, and the smart grid, fuel poverty is a serious and growing problem in Vermont. By our estimate, just over 71,000 people suffered from fuel poverty in Vermont in 2000, and in 2012 this number had grown to more than 125,000, or one in five Vermonters. Put another way, fuel poverty has grown by 76 percent over the past 13 years, despite major efforts by local and state actors in addition to federal government to fight poverty and stimulate the economy. Moreover, close to three-quarters of Vermonters in the lowest income decile are currently struggling with fuel poverty. Absent significant efforts from the public and private sectors, this problem will only grow more severe. Having a warm, comfortable, well-lit home is something, sadly, all too many Vermonters aspire to rather than experience.

Critically, our study does offer a poignant reminder that progressive energy and climate planning may have unintentional regressive effects on the poor that need corrected by government intervention. If, as some of us have argued, promoting energy security or sustainability is about managing tradeoffs,[64] such tradeoffs certainly arise in Vermont pitting some elements of environmental stewardship and decarbonization against elements of affordability and social vulnerability. When energy prices rise and households cannot compensate with sufficient improvements in efficiency or increased income, it is functionally the same as if they lacked access to reliable energy services altogether. In addition, less affluent Vermonters spend a larger share of their income on heat and electricity than other households, even though they consume less energy, hindering the accumulation of wealth needed to make investments to escape their poverty. When it doesn't kill and sicken people directly, fuel poverty forces households to cope by resorting to wearing coats and outdoor clothing indoors, sleeping together with pets or in one room to keep warm, relying on hot drinks, or even staying with relatives—actions that can all negatively impact mental health. Clearly, this is an issue that Vermont's people and leaders must recognize and address as a crisis, one that takes its toll on the state more seriously (in terms of fatalities) than automobile crashes.

With this in mind, our study offers recommendations for the Vermont legislature. Our data suggests they need to better fund investments in weatherization among low-income households; supplement federal weatherization programs; and endorse energy efficiency labels for homes, especially rented homes and apartments, which is where many of the fuel poor reside. Our study proposes that community groups and social service agencies scale up the training of energy efficiency coaches, disseminate energy conservation and low-cost efficiency materials (including information), and incorporate awareness and outreach on energy burdens into their existing programs. Our findings imply that other state agencies engage the problem in creative ways—whether or not through specific, identifiable programs—in order to support the sharing of information; improvements in housing efficiency, with an emphasis on rental properties; and appropriate fuel switching, with an emphasis on cold climate heat pumps. Our data lastly recommend that utilities and fuel providers offer extra assistance for disconnected households, allow for on-bill financing or PACE billing of efficiency improvements, and pursue (or at least consider) a business strategy of diversifying into energy services companies.

Ultimately, if fuel poverty is to be addressed in Vermont, and possibly elsewhere, then multiple actors need to be engaged in a concerted effort to implement a comprehensive suite of policy recommendations.

[64] Heffron et al., 2015; Sovacool et al., 2015; Sovacool and Linnér, 2015; Sovacool and Saunders, 2014.

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Original research article

# The United States regulatory compact and energy poverty

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ABSTRACT

Utility regulation in the United States (US) was founded partly on a consensus that raw marketplace economics ignored social justice, including universal service goals. The century-old 'regulatory compact' in most jurisdictions offers 'just and reasonable rates' in exchange for investment in public services. Justice has come to justify such low-income supports as discounted rates, arrearage forgiveness, limitations on service termination, and low/no cost energy efficiency. The consensus for regulation has now evolved to encompass carbon reduction, and has led to, amongst other things, the promotion of domestic forms of renewable energy known as 'distributed generation' (DG). However, such technologies potentially threaten the current regulatory balance that includes ameliorating energy poverty, because DG reduces utility sales but not utility fixed costs and so contributes to higher bills for low-income households that cannot afford such DG investments as rooftop solar, solar domestic hot water, and cogeneration.

The aim of this paper is to analyze how utility regulation might evolve to encompass modern energy developments, thus addressing both the goals of reducing carbon and amerliorating fuel poverty. It begins by reviewing the origin of US utility regulation and describes the regulatory compact that resulted. It then discusses possible balancing measures, including tax-based subsidies, system benefit charges (taxes) on DG, stricter application of just and reasonable regulatory principles, and low-income-specific approaches to DG.



## 1. Introduction[1]

Energy poverty has been widely addressed in this Journal[2] and elsewhere, as has climate change. This paper reviews policy options around adoption of clean Distributed Generation (DG) technologies, particularly rooftop solar power (photovoltaics a.k.a. PV), in the US electricity system and how they interact with regulatory protection of those in energy poverty. Its thesis is that the development of DG threatens these regulatory safeguards and that regulatory responses are therefore needed. It proposes measures for consideration, based on traditional regulatory principles, to reconcile the twin goals of addressing climate change and energy poverty.

While the paper is mostly based on specifics of US policy and technological deployment, the issues addressed are common in the developed world, where addressing climate change and energy poverty often appear to be in conflict with each other.

The paper begins with a description of the early financial necessities and political bargains that resulted in what we now think of as the US Regulatory Compact (Section 2.1). The century-old Regulatory Compact in most US jurisdictions offers "just and reasonable rates" in exchange for investor security, the promise of the opportunity to earn a limited but assured "reasonable" return on prudent investments for the public service. Justice, to varying degrees depending on the jurisdiction, has come to include goals of both environmental protection and economic justice. It then describes how policies under that Compact have evolved to become increasingly protective of those suffering from energy poverty (Section 2.2).

Against this backdrop, the paper describes DG technologies, including their environmental benefits (Section 3.1) and potential economic harm to those in energy poverty (Section 3.2). It points out the tensions between regulation and innovations such as DG with respect to the maintenance of equity (Section 3.3).

Finally, the paper proposes potential measures to be explored in quest of balances between investors and customers, between the

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[1] Expanded from presentations to the New Mexico State University Center for Public Utilities conferences "Current Issues 2014" (March 204) and "Current Issues 2015" (April 2015).

[2] *E.g.*, S. Bouzarivski et al., "A global perspective on domestic energy deprivation: Overcoming the energy poverty-fuel poverty binary," 10 Energy Research & Social Sciences 31–40 (November 2015); D. Hernández et al. "Benefit or burden Perceptions of energy efficiency efforts among low-income housing residents in New York City," 8 Energy Research & Social Sciences 52–59 (July 2015); L. Middlemiss et al., "Fuel poverty from the bottom up: Characterizing household energy vulnerability through the lived experience of the fuel poor," 6 Energy Research & Social Sciences 146–154 (March 2015).

http://dx.doi.org/10.1016/j.erss.2016.04.022
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environment and those in energy poverty, and between regulation and innovation (Section 4).

## 2. Development of the regulatory compact

### 2.1. The early bargain

Most of the 1800s were characterized by penny post cards and the golden glow of gas lights. Much like in the developing world of today, the range was a smoky wood stove, refrigeration (if available at all) was by farmed ice, any nighttime reading was by a flame, and personal communications arrived with twice-daily visits of the postman. All of that changed in the last quarter of the 19th century.

Less than 150 years ago, two great network inventions began the transformation of power and communication. Bell patented his "harmonic telegraph" in 1876, and, over the next two years, Edison developed his incandescent electric light.[3] This paper is about electricity regulation, but the early regulatory history of the telephone and electricity industries is similar and thus telephone industry history illuminates regulatory developments of the time. Both reached bargains of protection of consumers (Just and Reasonable rates) for protection of investment (reasonable rate of return).

Commercial success was less than immediate. Electricity did not reach half of America until the mid-1920s and the telephone until after World War II.[4] Bell's Company, that became the largest corporation in the world, American Telephone & Telegraph Co. (AT&T),[5] was so starved for capital that it nearly sold out to Western Union in 1877 for $100,000. (Western Union refused the offer.)[6] It was not until the next century that the telephone's market extended beyond urban business and wealthy homeowners.[7] Suffering from the aftermath of the panic, depression, and deflation of 1873, The Bell Company could only recruit capital by licensing local entrepreneurs and leasing equipment to them. Telephone equipment manufacture was also licensed based on Bell's patents, but the original patents expired in 1894 and patent contests were constant. Only after the Company bought out Western Union itself did a new charter in 1880 allow it to raise the capital it needed by defining itself as a "public service," and consolidation of the Company with its licensees began.[8] At this point, the company needed to justify the monopoly it was hoping to develop.[9] By 1910, however, there were only 3.9 million Bell telephones, two-thirds of the total; both Bell and non-Bell phones slightly more than doubled by 1920, so there were still only 8.3 million Bell telephones.[10]

Electricity, in contrast, was generally limited to local monopolies. Edison invented the incandescent lamp in 1878, but it was his development of the Pearl Street power station and network in the Financial District of lower Manhattan in 1882 that was revolutionary. The original service area of one-third of a square mile limited electric light to the offices, shops and restaurants that could afford it. Load factor was recognized as an economic issue almost immediately, since electricity cannot generally be economically stored and must therefore be used the instant it is generated—as much generation across as many hours as possible is economically preferable in order to better amortize the large capital cost of the generator. Perhaps for this reason, capital for expansion was difficult to raise and, much like Bell's, Edison's enterprise survived due to franchise and equipment sales.[11] One of those franchisees, Samuel Insull at Commonwealth Edison in Chicago, had tackled the load factor issue by offering low rates to entice large industrial customers away from generating their own power, and seeking out customers with complementary times of demand (including by promoting domestic appliances), thus creating a diversity of demand across hours. In this way Insull controlled unit costs by increasing the efficiency of his generation plant (load factor).[12] Scale was important to this strategy and, even better, monopoly. But the logic of electricity monopoly led to a late-nineteenth century debate about public ownership, particularly where populist movements were responding to growing concentrations of economic power on Wall Street.[13]

So it was that dominant players in both the telephone and electricity industries at the turn of the last century turned to political strategies to support their financial goals. The social and economic value of these dazzling new network technologies was recognized. Universal service at affordable prices was desired. But investors were slow to provide the large amounts of capital needed for massive expansion, uncertain of demand and afraid of competition. So Theodore Vail for AT&T and Samuel Insull for Commonwealth Edison tapped into existing legal and political streams to support their monopolizations.

Vail announced his "One Policy, One System, Universal Service" campaign in 1907, offering a deal with consumers: state (not municipal) regulation in exchange for an end to "destructive competition." An advertising campaign began in 1908 and lasted for decades.[14] It is well summarized in AT&T's 1910 Annual Report[15]:

> It is believed that the telephone system should be universal, interdependent and intercommunicating, affording any subscriber of any exchange to communicate with any other subscriber of any other exchange. . . . It is believed that some sort of a connection with the telephone system should be within reach of all. . . . It is not believed that this can be accomplished by separately controlled or distinct systems nor that there can be competition . . . It is believed that all this can be accomplished to the reasonable satisfaction of the public . . . Under control and regulation as will afford the public much better service at

[3] G. D. Smith, The Anatomy of Business Strategy: Bell, Western Electric and the Origins of the American Telephone Industry (Baltimore: Johns Hopkins Univ. Press, 1985) at 15, 27 [55]; T.P. Hughes, Networks of Power: Electrification in Western Society, 1880–1930 (Baltimore: Johns Hopkins Univ. Press, 1983) at 30–33 [26].

[4] A.C. Madrigal, "Most people didn't have a/c until 1973 and other strange tech timelines," The Atlantic (July 27, 2012), http://www.theatlantic.com/technology/archive/2012/07/most-people-didnt-have-a-c-until-1973-and-other-strange-tech-timelines/260427/ [35].

[5] S. Kleinfeld, The Biggest Company on Earth: A Profile of AT&T (New York: Holt, Rinehart and Winston, 1981) at 3 [27].

[6] G.D. Smith, The Anatomy of Business Strategy: Bell, Western Electric and the Origins of the American Telephone Industry (Baltimore: Johns Hopkins Univ. Press, 1985) at 27, 38 [55].

[7] G.D. Smith, The Anatomy of Business Strategy: Bell, Western Electric and the Origins of the American Telephone Industry (Baltimore: Johns Hopkins Univ. Press, 1985) at 25 [55].

[8] G. D. Smith, The Anatomy of Business Strategy: Bell, Western Electric and the Origins of the American Telephone Industry (Baltimore: Johns Hopkins Univ. Press, 1985) *generally, see esp.* at 5–9, 99, 104–107, 154–159 [55].

[9] *See* H. N. Casson, The History of the Telephone (Chicago: A. C. McClurg & Co., 1910) at 189–190 [10].

[10] R.W. Garnett, The Telephone: The Evolution of the Bell System's Horizontal Structure, 1876–1909 (Baltimore: Johns Hopkins Univ. Press, 1985) at 162–163.

[11] T.P. Hughes, Networks of Power: Electrification in Western Society, 1880-1930 (Baltimore: Johns Hopkins Univ. Press, 1983) at 21, 30–33, 39–42, 45–46 [26].

[12] T.P. Hughes, Networks of Power: Electrification in Western Society, 1880–1930 (Baltimore: Johns Hopkins Univ. Press, 1983) at 217–226 [26].

[13] G. Palast, J. Oppenheim, & T. MacGregor, Democracy And Regulation: How the Public Can Govern Essential Services (London: Pluto Press, 2003) at 109–111 [48].

[14] R.W. Garnett, The Telephone: The Evolution of the Bell System's Horizontal Structure, 1876–1909 (Baltimore: Johns Hopkins Univ. Press, 1985) at 130–131; T. Wu, The Master Switch: The Rise and Fall of Information Empires (New York: Vintage, 2011) at 51 [63]; A.B. Paine, In One Man's Life, Being Chapters from the Personal & Business Career of Theodore N. Vail (New York: Harper & Brothers, 1921) at 238 [46].

[15] A. Von Auw, Heritage & Destiny: Reflections on the Bell System Transition (New York: Praeger, 1983) at 5 [61]. *See* H. N. Casson, The History of the Telephone (Chicago: A.C. McClurg & Co., 1910) at 279 [10].

> less cost than any competition or government-owned monopoly could permanently afford . . .

Insull's argument for monopoly electricity systems was similar. Since 'free competition had proven a total and catastrophic failure,' State (not municipal) regulation should establish monopolies and guarantee returns to investors in order to encourage investment. In exchange, consumers were to be protected by transparent accounts and a standard of what is "just and reasonable." There are 52 US regulatory jurisdictions; each developed its own idea of what the regulatory compact should be and how the balance should be struck between investors and consumers. But the broad concepts of just and reasonable rates and universal service in exchange for investor protections quickly captured the nation. Wisconsin regulated electricity in 1907. New York, Vermont, New Jersey, and Maryland quickly followed, with every state falling in line by 1921.[16]

The market had not provided the results all segments of society wanted, so rules were invented: the regulation under assault today, a regulatory compact by which security for capital is exchanged for just and reasonable prices and universal service.

These were not deep philosophical agreements.[17] Vail and Insull were practical businessmen, albeit tapping into existing political and legal streams. The common law idea of common carriage had been firmly established in American jurisprudence by Munn v. Illinois in 1876.[18] The idea harks back to US railroad common carrier regulation (now called net neutrality) from the middle of the 19th century. But it really goes back to English concepts of common carriage first applied to "public callings" such as ferries and wharves more than 200 years before.[19]

> When, therefore, one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in that use, and must submit to be controlled by the public for the common good [. . .] when private property is devoted to a public use, it is subject to public regulation.

Closer to home, Massachusetts had already begun regulating railroads in 1869, which became nationally regulated by the Interstate Commerce Commission in 1887. Massachusetts extended regulation to gas in 1885 and electricity in 1887.

While no-one would say the regulatory systems cannot be improved, they have made substantial progress toward universal service and just and reasonable rates. With the help of government supports for rural areas, 90% penetration of electric service was achieved in the US in 38 years, which compares favorably with 76 years for cars and 56 for stoves. Near-universal telephone service took 61 years.[20] Residential electricity rates in the otherwise difficult period of 1960–2009 fell 25% in inflation-adjusted terms.[21] Residential telephone rates in the even more difficult post-AT&T-divestiture period of 1990–2007 were about flat in inflation-adjusted terms, rising less than two percent a year and remaining nearly half the business rate (on "value of service" principles, designed to encourage universal residential service with lower rates).[22] Certainly expansion of networks, management of load factors, and economies of scale allowed prices to fall. But for electricity these trends were maintained under conditions of both economies of scale and diseconomies of scale: nuclear power that was "too cheap to meter" followed by nuclear cost overruns, natural gas that was scarce then plentiful, oil that was a good substitute then subject to embargoes and price spikes, and coal that was cheap then dirty.[23] The telephone business had gone through the competitive disruptions of non-Bell equipment attachments (HushAPhone), competitive long distance (MCI), divestiture of equipment manufacture (Western Electric) and long distance, breakup of the Bell System, the growth of cell phones, and the waning of price regulation.

It can be argued that regulation has largely done its job of spreading the benefits of the new inventions of electricity distribution and telephone communication – eventually, for nearly everyone – while protecting against "ruinous competition" that retards capital investment.

At the same time, regulatory practice and legal jurisprudence have evolved considerably since the original round of political compacts inspired by Vail and Insull. As discussed in Section 2.2 below, applications of "just and reasonable" have evolved further into low-income Lifelines, Energy Efficiency, low-income assistance, Industrial Economic Development rates, and customer service rules such as arrearage management and extreme weather shutoff restrictions. Nevertheless, it remains true that "It is a general doctrine of American law, almost universal in its application to public utility companies. . . [t]hat these companies are under a duty to offer adequate service at 'reasonable' (or 'just and reasonable') rates" and are given the opportunity to achieve a reasonable return on all capital prudently invested and used and useful to public service.[24]

### 2.2. *Justice and reasonableness today*

Technology, attitudes toward markets, and goals for regulation have changed considerably since the days of Vail and Insull. For example, there is greater regulatory emphasis today on the environment, innovation, and economic justice. Other conditions have not changed very much: attraction of capital is important, as are just prices; fundamentally, unregulated markets have no social obligations unless they are explicitly imposed.

There is consensus today about the need for universal electricity and telecommunications service[25] and that there is a social responsibility to address energy poverty,[26] although approaches

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[16] G. Palast, J. Oppenheim, & T. MacGregor, Democracy And Regulation: How the Public Can Govern Essential Services (London: Pluto Press, 2003) at 111–113 [48].

[17] For a discussion of concepts of justice and energy justice, *see, e.g.*, B. K. Sovacool and M. H. Dworkin, Global Energy Justice: Problems, Principles, and Practices (Cambridge, U.K.: Cambridge Univ. Press, 2014) at 9 *et seq.*, 13 *et seq* [56].

[18] 94 US 113.

[19] Munn v. Illinois, 94 US 113 (1876) at 125–127, 130.

[20] A.C. Madrigal, "Most people didn't have a/c until 1973 and other strange tech timelines," The Atlantic (July 27, 2012), http://www.theatlantic.com/technology/archive/2012/07/most-people-didnt-have-a-c-until-1973-and-other-strange-tech-timelines/260427/ [35]; C. Gehrz, "The Spread of Technology Since 1900," The Pietist Schoolman (July 30, 2012), http://pietistschoolman.com/2012/07/30/the-spread-of-technology-since-1900/ [17].

[21] 2012 US Statistical Abstract [60]; Energy Information Administration, Table 8.10: Average Retail Prices of Electricity, 1960–2011, *in* R. Stevie et al., "Energy Efficiency Unmasked," Public Utilities Fortnightly (Feb. 2014) [57] http://www.fortnightly.com/fortnightly/2014/02/energy-efficiency-unmasked?page=0%2C7&authkey=46a4611ae6b34699f51f13530d9c23632fdc9c041030551dd705a2a27519c91b#sthash.HVdXHV4f.dpuf; US Energy Information Administration, Short Term Energy Outlook 2014 (May 6, 2014), http://www.eia.gov/forecasts/steo/ [15]. *See* G. Palast, J. Oppenheim, & T. MacGregor, Democracy And Regulation: How the Public Can Govern Essential Services (London: Pluto Press, 2003) at 99 [48], showing a much smaller gap between residential and industrial electricity prices after 1982, after consumer advocacy expansion.

[22] Federal Communications Commission. *See, e.g.*, J. W. Mayo, The Economics of New York Telecommunications (2015), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx%3FDocRefId%3D%257BD55E51A0-5196-4BBB-B73D-17FA02155E59%257D&ved=0ahUKEwi3zdHUrofMAhXGKh4KHbmuAqUQFggyMAU&usg=AFQjCNGpEcrke75ab3uQPDIlp9_Fkaigag.

[23] *See generally* Navigant Consulting Inc., "Evolution of the Eectricity Industry Structure i the U.S. And Resulting Issues" (Electric Markets Research Foundation, October 2013) at 6–12 [40].

[24] J.C. Bonbright, Principles of Public Utility Rates (New York: Columbia Univ. Press, 1961) at 33, 174 n. 2, 184 n. 15 [3].

[25] Communications Act of 1934, 47 U.S.C. Sec. 151 *et seq.*, *e.g.*, at secs. 151, 254.

[26] "[A] true ecological approach *always* becomes a social approach; it must integrate questions of justice in debates on the environment, so as to hear *both the cry*

**Table 1**
Massachusetts low-income energy efficiency summary for 2014.

| | Electric-planned | Achieved | Gas-planned | Achieved |
|---|---|---|---|---|
| Participants | 27,488 | 148% | 6840 | 183% |
| Expenditures | $54.8 M | 106% | $35.9 M | 107% |
| Benefits | | $129.6 M | | $93.9 M |
| Benefit: Expenditures (computed)[61] | | 2.2 | | 2.4 |
| Capacity | 3246 kW | 142% | | |
| Annual Energy | 27,259 mW h | 161% | 1,439,072 th | 183% |
| Lifetime energy | 260,056 mW h | 166% | 28,354,751 th | 180% |

differ widely to energy poverty.[27] At one extreme are utilities that argue, for example, that "Social programming is the responsible [sic] of government and not within Manitoba Hydro's mandate" and that "[P]overty programs are the responsibility of government."[28] At the other end of the spectrum are expansive approaches to address energy poverty, including rate discounts, arrearage programs, shutoff protections, and comprehensive no-cost energy efficiency installations.[29] Inbetween are jurisdictions that define energy poverty imprecisely (e.g., energy burden without reference to income) and only address that,[30] or those that take the issue seriously, but assume a Government safety net, strong energy codes, and feed-in tariffs solve most of the problem.[31] This is a broad description of the range of approaches, but it reflects the diversity of approaches, values, and governmental philosophies that are applied to energy poverty. Nonetheless, regulatory principles have emerged and evolved and a broad range of customer protections has evolved under the umbrella of "just and reasonable."

Box 1 summarizes modern just and reasonable principles, whilst Box 2 summarises examples of specific protections put in place based on these principles (though there is wide variation among US jurisdictions—whilst few jurisdictions provide all these protections, unconstrained competitive markets often do not provide any). I abstract this summary of principles[32] and protections[33] from my 40+ years of practice, observation of legislation and case law, and writing.

**Table 2**
Generation costs.

| | cents/kwh |
|---|---|
| Natural gas (advanced combined cycle) | 6.56 |
| Natural gas (conventional) | 6.71 |
| Wind | 8.66 |
| Geothermal | 8.96 |
| Coal (conventional) | 10.10 |
| Coal (advanced) | 12.30 |
| Advanced nuclear | 10.84 |
| Biomass | 11.11 |
| Solar[65] | 14.48 |

### 2.2.1. The Massachusetts model

Perhaps the most expansive consumer protection regulation is found in the Commonwealth (state) of Massachusetts.[39] Low-income (energy poverty) in Massachusetts is usually defined as a household with income at or below 60% of the state's median income[40]; this encompasses almost a third of the population. Significant advocacy on behalf of Massachusetts low-income energy consumers began in the 1970s[41] and has continued since without a break. The result is a broad net of assistance and protections. The Massachusetts Department of Public Utilities (DPU) first approved utility discount rates for certain low-income customers in 1979.[42] Department-ordered low-income energy efficiency programs go back almost as far.[43]

The terms low-income and energy poverty are used interchangeably in this paper. While it is possible for a low-income household to have sufficient household energy, where income is

*of the earth and the cry of the poor.*" Pope Francis, "Encyclical Letter Laudato Si of the Holy Father Francis on Care for Our Common Home" at par. 49 (The Holy See, 2015, emphasis in the original) http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html; [51]. "Some cross-subsidies exist to create a value that would otherwise be missed by pure markets, such as lower-cost power to low-income customers." Acadia Center (an environmental advocacy organization) [1], "Utility Vision" at 7, http://acadiacenter.org/document/energyvision/.

[27] For a discussion of concepts of energy poverty and social pricing, *see, e.g.*, B.K. Sovacool and M. H. Dworkin, Global Energy Justice: Problems, Principles, and Practices (Cambridge, U.K.: Cambridge Univ. Press, 2014) at 231–233, 253–255 [56]. For regulatory principles, *see generally* G. Palast, J. Oppenheim, & T. MacGregor, Democracy And Regulation: How the Public Can Govern Essential Services (London: Pluto Press, 2003) [48].

[28] Information responses to Manitoba Metis Federation (MMF) by Manitoba Hydro (a Crown corporation) in 2015/16 & 2016/17 General Rate Application (GRA), at II-18 and II-28, https://www.hydro.mb.ca/regulatory_affairs/electric/gra_2014_2015/index.shtml#rd_1 [36].

[29] *See* description of Massachusetts programs in Section 2.2.1. California and other US states also have expansive programs.

[30] G. Heffner et al., "Evaluating the co-benefits of low-income energy-efficiency programs" at 10–12 (International Energy Agency, Report of Dublin workshop Jan. 2011, June 2011) [23].

[31] Germany and much of continental Western Europe. J. Oppenheim and T. MacGregor, "Energy Poverty in Developed Countries: European Lessons for US, US Lessons for Europe?" (for International Association for Energy Economics, Venice, Sept. 2012), http://www.democracyandregulation.com/detail.cfm?artid=143&row=1 [42].

[32] E.g., G. Palast, J. Oppenheim, & T. MacGregor, Democracy And Regulation: How the Public Can Govern Essential Services (London: Pluto Press, 2003) [48].

[33] J. Oppenheim and T. MacGregor, Low Income Consumer Utility Issues: A National Perspective (Oak Ridge National Laboratory, 2000), http://www.democracyandregulation.com/detail.cfm?artid=22&row=5.

[39] This section is drawn from J. Oppenheim and T. MacGregor, "The Massachusetts Model for Low-Income Energy Service Delivery" (Interdisciplinary Cluster on Energy Systems, Equity and Vulnerability (IncluESEV) (Kings College London, Durham University, Lancaster University) Workshop, Durham, N.C., October 2011), http://www.democracyandregulation.com/detail.cfm?artid=140 [43].

[40] http://www.mass.gov/hed/community/energy/low-income-home-energy-assistance-liheap.html.

[41] The author has been among these advocates in Massachusetts and elsewhere in this period. The views expresed in this paper are not necessarily those of any past or current client.

[42] Affirmed in American Hoechest Corporation et al. vs. Department Of Public Utilities et al., 379 Mass. 408, 411–412 (1980). The decision was a pathbreaking refinement at the time of the just and reasonable concept: "There can be no question that the department's jurisdiction over the entire rate structure includes the authority to approve a reduced rate for certain customers. The question is whether the rate is unduly or irrationally discriminatory. "It is "axiomatic in ratemaking" that "different treatment for different classes of customers, reasonably classified, is not unlawful discrimination." While cost of service is a well-recognized basis for utility rate structures, it need not be the sole criterion. Any number of factors may justify a separate classification. (particular customer may be placed in separate class because of some or all such factors as size, location or nature of business). "*The nature of the use and the benefit obtained from it*, the number of persons who want it for such a use, and the effect of a certain method of determining prices upon the revenues to be obtained by the city, and upon the interests of property holders, are all to be considered" (emphasis supplied). [citations omitted]"

[43] E.g., the Department of Public Utilities cited "the Commonwealth's long and successful history (dating back to the 1980s) of delivering energy efficiency services" in its Order regarding energy efficiency programs in Dockets 09-121 et al. at vii (Jan. 28, 2010).

finite and small there is likely to be deprivation in some other category, such as food.[44] A household forced to make the choice between energy and food, for example, is not materially different economically if it makes one choice or the other. One may distinguish a low-income household in subsidized housing, however, where energy utilities are included in rent, but such a household would not be a utility customer.

Low-income rate discounts[45] in Massachusetts are generally 25% but range up to 35% off a total utility bill. In addition, the Federal LIHEAP provides cash grants for home heating fuel (including oil, still very common in New England), supplemented in some years by state funding.[46]

Even with these supports, and the substantial bill reductions due to energy efficiency discussed below, low-income households may still struggle to pay their utility bills. To protect against disconnection, utilities must offer payment arrangements for arrears, spreading payments over at least four months. Budget billing spreads projected billing equally over the year, to make it easier to pay lumpy winter heating bills. Low-income customers with specified levels of arrears may also sign up for the Arrearage Management Program, under which each timely monthly payment results in forgiveness of one-twelfth of the arrearage. Net costs to the utilities are spread across rates generally.[47] Utilities have come to appreciate the program because it fosters good payment behavior at very little net cost since most of the forgiven arrears would have been bad debt without the program—in the period 2009–2013, program participants paid nearly $70,000,000 while utilities forgave just over $66,000,000.[48]

Underlying these programs is a longstanding safety net of customer service protections enacted by the General Court (legislature) and the DPU over the years and codified in 1997 by the Electric Industry Restructuring Act. These protections provide, for example, termination moratoria in the winter; restrictions on shutoffs of service to households with infants or elderly occupants; prohibitions against late payment fees and security deposits; and detailed billing specifications.[49]

In the meantime, federal policy had pioneered along a similar track, with Congress enacting what is now the Low Income Home Energy Assistance Program (LIHEAP) in 1974, after the 1973 oil crisis,[50] and what is now the Weatherization[51] Assistance Program (WAP) in 1975.[52]

While the foregoing protections and supports are good short-term measures to provide some affordability, a longer term solution to energy poverty is to make homes more energy efficient, thereby bringing down the bill in the first place. Energy efficiency also meets climate goals.

The WAP programs are delivered by a network of community-based agencies, as provided by federal law; in Massachusetts, the Low-income Energy Affordability Network (LEAN) came to be formalized under Massachusetts law.[53] Low-income energy efficiency programs have been ordered by the Massachustts regulator since the 1980s[54] but were legislatively mandated and codified by the Restructuring Act of 1997 (effective March 1998).[55] Ten years later, the Green Communities Act (GCA) greatly expanded statewide funding of EE and thus funding of low-income efficiency programs.[56]

On average, about $4000 is invested per low-income household, with 100% Quality Control and periodic independent evaluation to assure savings and cost-effectiveness. Key program measures include:

- Insulation and air sealing
- Heating Systems repairs and replacements, including Air Source Heat Pumps
- Repairs to facilitate weatherization
- Pumps and motors
- Thermostats, other controls
- Lighting (LEDs, fixtures)
- Appliances, such as refrigerators, air conditioners
- Smart strips that turn off associated appliances (*e.g.*, a printer) when the main appliance is turned off (*e.g.*, a computer)
- Hot water saving measures, such as low-flow showerheads, aerators

Weatherization, heating systems, and lighting are by far the most common measures.[57]

The Low-income programs are "whole house" comprehensive programs; by design, they install all cost-effective measures in every treated housing unit. Over time, they are also broad, with the objective of reaching every low-income home whose occupants desire the service, subject only to budget constraints. As shown

[44] *See e.g.*, Bhattacharya, J., T. DeLeire, S. Haider and J. Currie 2002. "Heat or Eat? Cold Weather Shocks and Nutrition in Poor American Families," www.nber.org/papers/w9004. Washington, D.C.: US National Bureau of Economic Research (In cold climates, children in low-income families eat 14% fewer calories in winter than summer; their parents eat 15% less.) [7].

[45] Statutory since 1997. St. 1997, c. 164.

[46] First enacted in 1974 as Project Fuel (Office of Economic Opportunity). www.acf.hhs.gov/programs/liheap/library/history.html#74-79. LIHEAP was first enacted by P.L. 96-223 in 1981. *Id.*; http://www.liheapch.acf.hhs.gov/Funding/lhhist.htm. It is codified at 42 U.S.C. § 8621. *et. seq.*, 45C.F.R. § 96.80 *et. seq.*; see LIHEAP Program, http://1.usa.gov/bO5nYy. It is administered federally by the US Department of Health and Human Services (HHS).

[47] St. 2005, c. 240, §19(a).

[48] Compiled from utility reports to the DPU.

[49] All then-existing DPU consumer protection regulations were adopted by the General Court, though the DPU is allowed to make them more protective. St. 1997, §193; GL, c.164, §1F(7). "No distribution or generation company may disconnect or discontinue service to a customer for a disputed amount if that customer has filed a complaint which is pending with the department." G.L. c.164, §1F(2). "The department is authorized and directed to promulgate rules and regulations to establish service quality standards for each distribution, transmission, and gas company, including, but not limited to, standards for universal service . . ." G.L. c.164, §1F(7). St. 2005, c. 240, §19(a). St. 2005, c. 240, §19(b). G. L. c. 164, §§124A, 124F, 124H; 220 CMR 25.03(1). The DPU often extends winter moratoria to mid- or late-April, depending on the weather and energy prices. 220 CMR 25.05. *See* Charlie Harak, Utilities Advocacy For Low-Income Households In Massachusetts (National Consumer Law Center, 2nd ed. 2007) [20], http://www.masslegalservices.org/system/files/utility-handbook-2d-ed.pdf. There are also rules regarding billing and collection.

[50] 42 U.S.C. § 8621. *et. seq.*, 45C.F.R. § 96.80 *et. seq.*; see LIHEAP Program, http://1.usa.gov/bO5nYy.

[51] In its narrowest sense, the term "weatherization" refers to building insulation and air sealing. However, the term is often used more generally to encompass the full set of energy efficiency measures discussed in this section. *E.g.*, The Millenium Committee, "Weatherization Plus: Opportunities for the 21st Century" (US Department of Energy, 1999), https://www1.eere.energy.gov/wip/pdfs/weatherization_plus.pdf.

[52] First enacted in 1975 as Emergency Energy Conservation Program (Community Services Administration). www.acf.hhs.gov/programs/liheap/library/history.html#74-79. WAP was enacted in 1977. http://www.liheapch.acf.hhs.gov/Funding/lhhist.htm. It is codified at 42 USC sec. 6861. *See* www.eere.energy.gov/weatherization, www.waptac.org/sp.asp?id=1437. It is administered federally by the US Department of Energy (DOE).

[53] St. 1997, c. 164; low-income efficiency provisions affirmed by the Green Communities Act, G.L. c. 25, sec. 19(c) (St. 2008, c. 169, sec. 11). The author is regulatory counsel to LEAN.

[54] *E.g.*, the Department of Public Utilities cited "the Commonwealth's long and successful history of delivering energy efficiency services" in its Order regarding energy efficiency programs in Dockets 09-121 et al. at vii (Jan. 28, 2010).

[55] St. 1997, c. 164, sec. 37; G.L. c. 25, sec. 19 (c).

[56] St. 2008, c. 169, sec. 11; G.L. c. 25, sec. 19(c).The Green Communities Act also designated a seat for the network on the newly created Energy Efficiency Advisory Council. St. 2008, §11; GL, c. 25, §22(a).

[57] Compiled by James Collins, Action for Boston Commnity Development, for Low-Income Energy Affordability Network, *in* J. Oppenheim, "Addressing Energy Poverty Through Efficiency" at 11 (Low-Income Energy Affordability Network, in press 2016).

**Box 1**
Modern regulatory just and reasonable principles.

1. Rates may reflect only known, verified, measurable, and prudent investment and expenses,
2. Rates may reflect investments only if they are used and useful (economic),
3. Rates may reflect investments only if they are cost-beneficial on the basis of benefits to ratepayers that are concrete and measurable,
4. Rates may reflect investments only if they are the least-cost means to an agreed-upon objective, and the objective has been deemed a priority,
5. Rates must be affordable, and
6. Rates must reflect cost-causation and customer receipt of benefits.

in Table 1, the programs are robustly cost-effective, exceed goals, and provide savings at lower-than-projected costs to achieve.[58] Additional benefits, not included above, accrue from economic development and greenhouse gas reductions.[59] In Massachusetts, $1,000,000 invested in gas energy efficiency, for instance, results in 46.7 job-years.[60]

Participant heating energy consumption is reduced 40%. The latest energy savings (impact) evaluation of the Massachusetts low-income program for one-to-four unit buildings found these household energy savings[62]:

- gas heat insulation/air sealing savings, 22% (from entire household usage), 29% (only heating);
- gas heating system replacement savings, 17% (household), 23% (heating);
- refrigerator replacements, 63%;
- lights replaced, 65%.

Consistent with the Regulatory Compact, utility rates are adjusted to account for the loss of sales and utilities receive a regulated share of these savings, in addition to benefits that are ultimately passed on to ratepayers, such as reduced capital investment for distribution, reduced bad debt, and reduced collection costs.

## 3. Disruptive technologies now challenge the regulatory bargain

The Regulatory Compact was created, in part, as a response to disruptive technology to spread the benefits of innovation, control prices, and promote equity and universal access. Now, new disruptive technologies offer important benefits but threaten the Compact's continued achievement of affordability, equity, and universal access. Distributed generation (DG) promises greater reliability and reduced greenhouse gases (GHGs), but at increased cost and potentially outside the regulatory structure. This section outlines the regulatory issues that arise.

### 3.1. Distributed generation (DG) benefits and costs

DG technologies include renewable energy (RE) such as photovoltaics (PV) and solar domestic hot water (SDHW), combined heat and power (CHP or cogeneration), and microgrids. The idea behind the promise of reliability is that distributed resources can continue to be available if the grid suffers an outage; except for SDHW, this, however, depends on isolating electronics not now commonly in use. Greenhouse Gas reduction is based on the substitution of non-fossil resources (sun and wind) for fossil fuels. These are important potential benefits of DG.

Renewables can also be installed as central stations. While commonly not the least-cost alternative for central generation, current total costs for central renewables are considerably less than for distributed PV[63] and may, as described in the next section, become economic in select locations as technology develops.

Thus, by itself, RE DG technology itself often raises average costs of grid electricity to customers. Even though renewable energy costs have fallen sharply, they generally remain more costly than conventional resources, so adding them to the generation mix will increase average generation costs from a customer point of view. The EIA projections for 2018 in Table 2 are unlikely to be precisely correct, are distorted by various government policies and subsidies, and should be viewed as a midpoint in a range, but they are likely to be directionally correct.[64]

However, current regulatory policy subsidizes RE by means of utility purchase requirements (Renewable Portfolio Standards (RPSs)), mandatory Purchased Power Agreements (PPAs) irrespective of least-cost alternatives, which often require purchase of otherwise uneconomic power, and net metering, which usually reduces DG-owner bills by more than the utility cost of the power

[58] J. Oppenheim, "EEAC Low-Income Workshop Briefing Paper" (LEAN, Feb. 2015) [44]; LEAN presentation to Mass. Energy Efficiency Advisory Council workshop (Feb. 26, 2015); both available at www.ma-eeac.org/2-26-15-multifmily-and-low-income-workshop-meeting-materials; Massachusetts Program Administrators, Three-Year Plan; available at ma-eeac.org/plans-updates [38].

[59] See Massachusetts Program Administrators [38], Three-Year Plan [for Energy Efficiency]; available at ma-eeac.org/plans-updates. Consideration of these benefits is required in Massachusetts, but not quantification. G.L. c. 25, sec. 21(b)(2)(viii)-(ix) re: economic development, sec. 22(b) re: environment.

[60] Computed from Environment Northeast, "Energy Efficiency in Massachusetts: Engine of Growth" (Oct. 2009), see J. Howland et al. [25], "Energy Efficiency: Engine of Economic Growth [in New England]/A Macroeconomic Modeling Assessment," (Environment Northeast, Oct. 2009). See also J. Oppenheim and T. MacGregor [41], "Energy Efficiency Equals Economic Development," Entergy Corp., 2008, http://www.democracyandregulation.com/detail.cfm?artid=135&row=0.

[61] Cost-effectiveness is defined by DPU enactment (D.P.U. 08-50-B (2009), Energy Efficiency Guidelines at sections 3.4.3.1, 3.4.4.1(b)(ii), 3.4.4.2(b)(ii)), *aff'd* D.P.U. 11-120-A, Phase II (2013), which are documented in the "Technical Reference Manual" (TRM) 416 *et seq.* (Appendix C), available at http://ma-eeac.org/studies/. Non-energy benefits are documented in NMR Group, Inc., "Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation."Madison, Wisc.: *Tetra Tech*, 2011). Updates to NEIs in the TRM are pending as this is written.

[62] The Cadmus Group, "Low Income Single Family Program Impact Evaluation" (2012), http://ma-eeac.org/studies/ at 29–30, 32, 39, 40–41 [9].

[63] Some central station solar, with tracking to maximize output and in locations with very favorable solar regimes, may be cost-competitive with natural gas, 6.6–11.7 cents/kWh for central, utility-scale PV v. 12.3–19.3 cents for residential scale rooftop PV. B. Tsuchida et al., "Comparative Generation Costs of Utility-Scale and Residential Scale PV in Xcel Energy Colorado's Service Area" (The Brattle Group for First Solar, July 2015) [59]. The US Energy Information Administration (EIA) projects central wind projects to cost 8.66 cents/kWh. Annual Energy Outlook 2013 (Dec. 2012) [16].

[34] *See* J.C. Bonbright, Principles of Public Utility Rates (New York: Columbia Univ. Press, 1961) at 75, 344 [3].

[35] J.C. Bonbright, Principles of Public Utility Rates (New York: Columbia Univ. Press, 1961) at 379 *et seq* [3].

[36] *Also see* St. 2005, c. 240, §19(a) (Mass.).

[37] B. Biewald et al., "Performance-Based Regulation in a Restructured Electric Industry" at c. 5 (Synapse Energy Economics, for National Association of Regulatory Utility Commissioners, 2007), http://www.synapse-energy.com/sites/default/files/SynapseReport.1997-11.NARUC_PBR-in-a-Restructured-Electricity-Industry.97-U02.pdf.

[38] R. Wilson and B. Biewald, "Best Practices in Electric Utility Integrated Resource Planning" (Regulatory Assistance Project, 2013), file:///C:/Users/Theo/Downloads/RAPSynapse_WilsonBiewald_BestPracticesinIRP_2013_JUN_21.pdf.

[65] As noted above, some central station solar can be less expensive.

[64] The US Energy Information Administration (EIA) projects central wind projects to cost 8.66 cents/kwh. Annual Energy Outlook 2013 (Dec. 2012) [16].

**Box 2**
Modern regulatory just and reasonable protections.

- Reduced or eliminated late payment fees, which are assessed for payments made past a specified due date. The charges can be particularly onerous for low-income households and at one time often exceeded many consumer interest rates.
- Flat/inverted rates, reduced fixed customer charges, lifeline rates for low-income customers. Low-income customers generally use less electricity than other residential customers and so are disadvantaged by rate designs that charge more per kWh for lower consumption. The listed just and reasonable rate designs reverse the tendency to charge more per unit for smaller use by, for example, assessing higher rates on larger consumption, reducing the charge for no use to reduce the average charge per unit, and providing a lower rate for small anounts of essential use.
- Rate discounts. Discounted rates are often provided to identified low-income households. Some are based on a specified percentage of a household's income.
- Average pricing. By averaging prices, rates in remote areas are less than they would be if geographically granular costing principles were strictly applied.[34]
- Value of service pricing to promote universal service.[35] This was formerly used in telephone ratemaking to charge above-incremental-cost prices for optional services such as TouchTone and Call Waiting, and to business lines, in order to generate a fund that was used to lower residential prices from what they would otherwise be.
- Regulated or eliminated security deposits, which can be particularly difficult for low-income households to raise.
- Billing requirements and protections, such as arrearage management.[36] This includes minimum time periods to pay bills and forgiveness of arrears in exchange for adhering to a payment plan agreement.
- Shut-off protections: extreme weather seasons, infants, elderly, hardships. Protections include restrictions on termination of service to specified vulnerable customer classes and at times or seasons of severe weather.
- Service quality requirements, including maintenance of specified voltages, pressures, and minimization of service outages.[37]
- Integrated Resource Planning (IRP). Capital investment is overseen in order to screen alternatives to determine which is the least-cost approach to reach an approved objective. The alternatives can include utility or non-utility investment.[38]
- Energy Efficiency (EE) (see next section).
- Other environmental protections, including Renewable Energy and carbon controls.

for which DG substitutes. In these instances, the additional cost to the utility is simply added to the rates paid by all customers. Such costs of RE are thus generally socialized, causing all rates to rise. RE is also subsidized by tax policies, such as production tax credits and investment tax credits. Importantly, GHG reduction can be accomplished by means that lower total bills, principally very large expansions in energy efficiency investment, including time-of-use shifting by demand response and storage.[66]

DG should not be confused with consumption reduction; rather, DG simply shifts consumption off the utility grid to non-grid sources of electricity and hot water, often facilitated by ratepayer-financed subsidies. Nor should DG necessarily be confused with demand (peak use) reduction; the solar (PV) production peak, for example, often does not occur at the time of system or local residential consumption peaks.[67]

Nevertheless, distributed PV has been encouraged by such regulatory strategies as net metering, by which PV owners are paid the retail price of electricity for all the electricity they generate,[68] without reference to the energy or capacity (peak) value of the electricity produced, the intermittent and thus unreliable nature of that production, and the resulting undiminished need for the fixed costs of back-up capacity, transmission, and distribution. This is a direct subsidy by which lower-income customers (among others) subsidize those wealthy enough to invest in PV,[69] since lower-income customers without PV pay the increased rates while PV owners benefit from reduced utility consumption and thus lower utility bills. Other regulatory subsidies currently in vogue include rebates, time of use (TOU) rates, smart meters, and lack of standby rates that would otherwise pay the costs of having the grid available upon a failure of DG. Tax credits represent an additional (non-rate) subsidy. In addition, DG imposes costs on the grid, usually socialized (rolled into all rates) for monitoring, control, and integration, as well as reserve requirements needed to respond to demand variability (including the instantaneous loss of electric supply when a cloud passes over) and the ability to handle two-way flows. If DG achieves scale, it also poses risks over time of existing transmission and distribution investment becoming redundant; if DG fails or regulatory subsidy policy changes, there is a risk that consumer DG investments will become uneconomic as well.

From a customer point of view, DG net metering can thus often be seen as successful regulatory arbitrage (taking advantage of simultaneous different prices for the same commodity, electricity), in essence selling electricity at the retail price while buying it at a lower, subsidized price reserved for solar. Such customers avoid cost responsibilities for maintaining the utility grid they use that are covered only by customers of the regulated grid.

### 3.2. DG raises rates and bills

As shown in the previous section, DG raises rates and bills for customers not investing in DG, such as low-income households. Introducing DG displaces consumption from the utility without appreciably reducing utility fixed costs. (This is not to deny small utility savings from reduced power prices since lower demand for power reduces the need for the most expensive power sources.) Since fixed costs are thus spread over fewer kWh of consumption, average rates must rise. This will be wholly or partially offset for those who invest in DG, such as rooftop solar. For those who do not invest in DG, and whose on-grid consumption therefore remains the same, bills will rise. This risks a potential spiral, where rising prices provide increasing incentives for customers to move consumption from the grid (bypass) in favor of DG resources such as rooftop solar. This is exacerbated by regulatory policies that raise prices further with ratepayer-financed subsidies to DG such as rebates and net metering. Higher rates encourage still more DG bypass, which leads to even fewer kWh sold over the grid to pay fixed costs, thus raising grid rates still further. As rates spiral up in this way, and total on-grid consumption spirals down, a two-tier structure emerges: customers who invest in DG (often with a subsidy) pay less for their power while customers who cannot invest in DG pay more. Eventually, in the most extreme spiral scenario, only those who do not invest in DG may be the last ones on the grid; these are likely to largely be low-income customers unable to

[66] P. Knight et al., "Clean Power Means Lower Bills for Consumers" and "Bill Savings in a Clean Energy Future" (Synapse Energy Economics for Energy Foundation, July 2015), www.synapse-energy.com/project/consumer-costs-low-emissions-futures [28].

[67] J. Lazar, "Teaching the 'Duck' to Fly" (Regulatory Assistance Project, Jan. 2014) [30].

[68] *E.g.*, G.L. c. 164, secs. 138-141 (Mass.), 220 CMR 18.00 *et seq.* (Mass. Dept. of Public Utilities); Mass. General Court, H.4173 (Conference Report) (April 2016) (reducing net metering credits), malegislature.gov/bills/189/House/H4173, Acts of 2016, c. 75, malegislature.gov/bills/189/Senate/S1979/history.

[69] A. Brown et al., "Valuation of Distributed Solar: A Qualitative View" (Electricity Journal vol. 27, no. 10, Dec. 2014 at 27), available at www.hks.harvard.edu/hepg/brown_papers.html [5].

afford DG investment, which raises a serious equity issue.[70] Taken to this extreme, DG bypass could also threaten the economic viability of electric utilities and their grids, which the more dramatic have termed a "death spiral."[71]

Telecommunications went down a similar road of new technology unhooking from the wired network as the industry unravelled its web of cross-subsidies. Thirty-eight percent of American households are now wireless-only; Morgan Stanley projects this to reach as many as 60% by 2018. Wireline subscriptions are down 48% since 2002, network usage minutes of use about 60% since 2000. After decades of regulated price stability, wireline prices are up (a review of local New Jersey prices shows prices up more than five times since 1982);[72] cellphone replacements are not cheap, provide lower quality, and are less reliable. New communications technologies may prove worthwhile for large customers; but less so for small residential customers. And this is obviously not economically favorable for wireline telephone carriers, either. Projections are, for instance, that BT, the former British Telecom, will not complete its transition from wires to fibre and over-the-air radio until 2025. In the US, while it is curtailing investment in its copper network, Verizon does not even seem to be able to complete a transition to fibre, having stopped extending its FiOS fibre network into new cities and towns five years ago and not completing its rollout in New York City.[73]

Of course, increases in fossil fuel prices may cause utility rates to rise in the absence of DG, and the costs of renewables may continue to decline, thus lowering the price of DG. Even so, the ability to invest in DG will remain out-of-reach for those with low incomes and subsidizing DG will cause utility rates to be higher than they would be in the absence of subsidies.

Rising fossil fuel prices also have a negative impact on the cost of RE. Current unusually low gas price projections may be distorting decision-making by encouraging reliance on gas to back up intermittent RE. Gas could turn out to be much more expensive in the long run than now forecast, due to local pipeline constraints (especially in harsh New England winters), price volatility, and a national policy to export LNG and thus join the higher-priced world market. Gas prices in Asia are more than double those in the US.[74] Unrealistically low gas price projections could contribute to missing an opportunity for developing, for example, distributed battery storage technologies.

It is also important to consider future scenarios in which advanced batteries for the storage of DG electricity might become truly economic. Not today, but in a world of such advanced batteries, Morgan Stanley calculates a future on-grid v. off-grid differential, with reasonable reliability and depending on regional differences, of 26 cents per kWh on-grid v. 12 cents off, or 18 cents v. 14 cents, depending on the state. These are certainly not precise forecasts, but Morgan Stanley projects that, with California rates rising at 5% a year, solar reaching 20% penetration, and a policy under which solar pays 50% of the fixed grid fee, off-grid solar with storage will cost only 12 cents per kWh compared to 26 cents for grid electricity in 2020. In New York, according to Morgan Stanley projections, an off-grid Stirling engine with storage (also producing hot water and some heat) would produce electricity at 14 cents per kWh compared to grid electricity at 18 cents.[75] These projections depend on many uncertain forecasts and assumptions – for example, residential-scale fuel cells or micro-combined-heat-and-power could become economic – but they point in an ominous direction.

Rocky Mountain Institute offers similar projections—base case grid parity on average for solar in New York and California by 2020–2030, sooner for a significant minority of customers and sooner with expanded energy efficiency and/or technological improvements.[76]

A similar future is not hard to find today. In Germany, my wife and I have a house where we have paid as much as about 50 cents (US) a kWh (it was about 18 cents in 2000) while our friends who invested in PV are on a solar feed-in tariff that pays them nearly that much for their production. This is with Germany at about 25% PV production; long-term German policy is to get to 80%.[77] Not surprisingly, there has been something of a consumer backlash,

[70] "For residential sector NEM [solar net metring] systems, we find that the customers installing NEM systems since 1999 have an average household income based on 2010 census tract data of $91,210, compared to the median income in California and in the IOU service territories of $54,283 and $67,821, respectively." California Public Utilities Commission Energy) Division, "California Net Energy Metering (NEM) Draft Cost-Effectiveness Evaluation" at 110 (2013), https://ethree.com/documents/CSI/CPUC_NEM_Draft_Report_9-26-13.pdf. The dilemma is not limited to the US. E.g., D. Grover, The British Feed-in Tariff for small renewable energy systems: Can it be made fairer? (Oct. 2013, Grantham Research Institute on Climate Change and the Environment), http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/02/british-feed-in-tariff-renewable-energy.pdf; http://notrickszone.com/2012/12/17/damning-german-study-confirms-renewable-energy-feed-in-act-redistributes-wealth-from-the-poor-to-the-rich/#sthash.By8DDNVl.dpbs (re: Cologne Institute for German Economics study); G. Walker, "Decentralised systems and fuel poverty: Are there any links or risks?", 36 Energy Policy 4514 *et seq.* (2008).

[71] For a discussion of these and related issues, *see generally* Harvard Electricity Policy Group Plenary Session, "The Electric Utility Business Model Going Forward: Maximalist, Minimalist, or Somewhere in Between?," Rapporteur's Summary at 33 *et seq.* (Session Two, Dec. 12, 2013) [21], available at http://www.hks.harvard.edu/hepg/rlib_rapporteurs_reports.html#2013 "[G]overnment-mandated help for renewables, may eventually erode the economics of the incumbent utility," W. Buffet, "Chairman's Letter," *in* Berkshire Hathaway, Inc., 2015 Annual Report at p. 23, http://www.berkshirehathaway.com/2015ar/2015ar.pdf *See* B. Radford, "Unwinding the Death Spiral," *Public Utilities Fortnightly* (May 2014), fortnightly.com/fortnightly/2014/05/unwinding_death_spiral#sthash.C8AUNp.dpu [53].

[72] Bruce Kushnick, "Verizon New Jersey Local Service Increases, 1982–2014—440%" (April 17, 2014), http://newnetworks.com/2014/04/verizon-new-jersey-local-service-increases-1982-2014-440/; see generally Bruce Kushnick, "Local phone charges have soared since the break-up of AT&T," (accessed April 22, 2014), http://www.niemanwatchdog.org/index.cfm?fuseaction=ask_this.view&askthisid=00233 [29]. Other data from Federal Communications Commission and Morgan Stanley research *in* Morgan Stanley, "Batteries+Distributed Gen. May Be a Negative for Utilities" (March 4, 2014) [39].

[73] D. Thomas et al., "The reinvention of BT," Financial Times at 12 (May 19, 2015) [58]. J. Brodkin, "Verizon nears 'the end' if FiOS builds," ars technica (Jan. 2,3 2015) [4], www.arstechnica.com/business/2015/01/verizon-nears-the-end-of-fios-builds/; M. Flamm *et al.*, "City to audit Verizon's delayed rollout of FiOS," Crain's New York Business (Sept. 17, 2014), www.crainsnewyork.com/article/20140917/TECHNOLOGY/140919885/city-to-audt-verizons-delayed-rollout-of-fios. *But see* S. Castellanos, "Verizon to make $300 M investment in Boston fiber network," Boston Business Journal (April 16, 2016) (in low-income neighborhoods), http://www.bizjournals.com/boston/blog/techflash/2016/04/verizon-to-make-300m-investment-in-boston-fiber.html?ana=e_du_pub&s=article_du&ed=2016-04-12&u=pXCEmLy6GYjs6a9MiQXEJ6HlucY&t=1460503101&j=72294552.

[74] Current gas prices are around $2.40 per MMBTU in the US, $6.65 in Asia and $5.20 in the UK. However, the latter have been as high as $19 and $10, respectively, so many analysts project US gas to be competitive abroad despite liquifaction and transport costs of $5.00–$5.50. E. Crooks, "US will be a gas supplier to the world by tomorrow," Financial Times at 17 (Jan. 11, 2016). Europe is prepared to import LNG [64]. *But see* [19].

[75] Morgan Stanley, *id.* On the other hand the US Energy Information Administration considers it possible that EE and DG will result in 2040 electricity sales nationwide that are about the same as in 2012, although total consumption would increase 7% [37].

[76] P. Bronski et al.,"The Economics of Grid Defection" at 7–8 (Rocky Mountain Institute, Feb. 2014), http://www.rmi.org/PDF_economics_of_grid_defection_full_report [6].

[77] Jeffrey Altman, "Electricity Markets Out of Balance: The German Experience," *State and Local Energy Report* (Feb. 2014) [2], http://stateenergyreport.com/2014/02/05/electricity-markets-out-of-balance-the-germany-experience/; P. Hockenos, "Power Hungry," Foreign Affairs (Sept. 26, 2013), http://www.foreignaffairs.com/articles/139950/paul-hockenos/power-hungry; F. Dohmen et al., "Germany's Energy Poverty: How Electricity Became a Luxury Good" (Spiegel Online, Sept. 4, 2013) [14]. See S. Sercu, "Renewables: Clash Between Expectation and Reality" at 8 (for Harvard Electricity Policy Group, Dec. 13, 2013), http://www.hks.harvard.edu/hepg/Papers/2013/Sept%202013/Sercu_Stefaan.pdf [54]. There are also significant transmission and other costs that are socialized in rates. At 7. On the other

to which there has been Government response but no dilution in commitment to renewables.[78]

The backlash is based on economic realities that cross European and American borders. As Thomas Piketty has demonstrated, Western economic systems are producing growing inequality. The top decile income share in the US is the highest it has been for at least 110 years—90 years in Britain, 70 years in Germany, 40 years in Sweden, 30 years in France.[79]

In the US, low-income families constantly choose between heating their homes and feeding their children. In cold climates, children in low-income families eat 14% fewer calories in winter than summer; their parents eat 15% less.[80]

The connection between energy bills and health costs is made by Boston Medical Centre research showing that a 2% annual energy price increase over 15 years increases medical costs by $70B (NPV) [Net Present Value]. Poor households reduce their caloric intake when energy bills rise due to weather extremes, to the detriment of their health. Thus Boston Medical Centre medical researchers also found that reductions in food expenditures in order to pay for cold weather energy bills led to a high incidence of pediatric emergency cases with weights below the fifth percentile.[81]

### 3.3. Regulation, innovation, and equity

The development of DG has exposed a tension between goals related to climate change and affordability, thus illustrating the difficulty regulation has with integrating innovation while maintaining equity. Public policy has also added pressure to the debate over DG because of a desire for innovation. Just as addressing climate change before it, innovation may be becoming a new element of the regulatory compact.

Regulation can retard innovation. This is no accident; unmanaged innovation can be costly and risky to both consumers and investors. As a result, much of the innovation in telecommunications and energy has occurred outside the low-risk regulated industries. Bell Labs invented radio for long distance, computers for switching, and cell phones for mobile telephony, but delayed their rollouts to protect existing capital investments in wires, electromechanical switches, and pay phones. It took litigation, and ultimately the breakup of the Bell System, to develop microwave for long distance as well as cell phones. Similarly, it took federal legislation to get electric utilities to seriously consider the economics of natural gas-fueled combined cycle generation.[82]

Thus it is difficult to predict when technological delays will benefit ratepayers and consumers. Electronic switching and combined cycle generation proved to be beneficial. On the other hand, risks to both investors and consumers are illustrated by AT&T's videophone, and solar hot water as the answer to the 1973 oil embargo—investors lost money and consumers were stuck with products that did not work. Perhaps today's internet of things, advanced batteries, and smart meters will meet similar fates, not to mention rooftop PV. Not every flashy new technology gathers a permanent market. After the "stranded costs" of nuclear power plants when sold at a loss after deregulation, not to mention the unpredicted cost overruns that preceded, perhaps utilities and their regulators have learned to be justifiably cautious about shiny new toys without proven economic results. In any case, low-income consumers of essential utility services require particular protection.

Successful innovation can also be costly. In the case of cell phones, for example, consumers have sacrificed reliability, voice quality, and price in exchange for mobility. What of those who cannot afford the tradeoff? We have already seen how DG can increase electricity rates not only by its greater cost but also by its reducing utility revenue without reducing utility fixed costs. In fact, DG may increase electricity distribution costs by requiring transformers and other upgrades, as well as electronics for monitoring and integration. Again, what of those who cannot afford the tradeoff to obtain an essential service?

Managing such issues is what regulators do, in an open, transparent, democratic way, integrating social and economic goals using tools such as public rate cases, rulemaking proceedings, and public fora. This is very different from markets, which also manage such issues but in more of a one-dollar, one-vote way without reference to social goals or competing interests. In the case of DG, there is a wide array of interests and constituencies to balance:

- RE and DG sellers,
- Electric Vehicle (EV) sellers and manufacturers,
- Meter manufacturers,
- Data miners,
- Large customers that need more stringent reliability, however costly,
- Large customers that can easily shift load under time-of-use (TOU) rates or time-varying rates (TVR),
- Residential customers with the means and interest to invest in DG including PV, despite its first cost,
- Environmentalists whose chief concern is with saving the planet, and

hand, Germans use electricity very efficiently, so residential bills average only about 2% of household income. H. Harvey, "A Tale of Two Countries: Renewable Energy in Germany" at 5 2013) [22], http://energyinnovation.org/wp-content/uploads/2013/09/Reflections-on-Germanys-Energy-Transition.pdf. J. Pang et al., "Germany's Energiewende," Public Utilities Fortnightly at 14 (Nov. 2014) [47].

[78] *E.g.*, Craig Morris, "German PV feed-in tariffs to drop by 1.4 per cent" (Nov. 5, 2013), http://energytransition.de/2013/11/german-pv-feed-in-tariffs-to-drop/ ; "German cabinet approves changes to feed-in tariff, including taxing self-consumption of solar PV" (April 8, 2014), *Solar Server*, http://www.solarserver.com/solar-magazine/solar-news/current/2014/kw15/german-cabinet-approves-changes-to-feed-in-tariff-including-taxing-self-consumption-of-solar-pv.html. C. Weber, "Lessons to be Learned from the German Renewables Experience" at 8 for Harvard Electricity Policy Group, Dec. 13, 2013), http://www.hks.harvard.edu/hepg/Papers/2013/Weber_HEPG_20131206.pdf [62]; H. Harvey, "A Tale of Two Countries: Renewable Energy in Germany" (Energy Innovation, 2013) [22], http://energyinnovation.org/wp-content/uploads/2013/09/Reflections-on-Germanys-Energy-Transition.pdf. Giles Parkinson, "Germany Expands Renewables Targets, Considers 'Virtual Baseload' (RenewEconomy, December 4, 2013), http://www.greentechmedia.com/articles/read/germany-expands-renewables-targets-considers-virtual-baseload [49]. Similarly, the United Kingdom is about to reverse a ratepayer subsidy for renewable energy producers. P. Clark, "Summer Budget: End of climate levy relief undermines [renewable power utility] Drax shares," Financial Times (July 8, 2015) [11].

[79] T. Piketty, Capital in the Twenty-First Century, Harvard Univ. Press, 2014 [50]; R. Kochhar, "A Global Middle Class is More Promise than Reality (Pew Research Center, July 8, 2015), pewglobal.org/2015/07/08/a-global-middle-class-is-more-promise-than-reality/; S. Donnan et al., "Middle class smaller and poorer than thought," Financial Times at 2 (July 9, 2015).

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[82] J. Gertner, The Idea Factory (New York: Penguin Press, 2012) at 227, 280–281, 286–288, 295–297 (regulatory delays, 289 (AT&T marketing study: "no market ... at any price"); Jon Gertner *in* Computer History Museum interview (Special Interest Group/Computers, Information and Society, 2012), sigcis.org/node/328 (equipment must last 30 years); *see* T. Farley, "Mobile Telephone History," Telektronikk at 22 *et seq.* (3/4, 2005), telenor.com/innovation/telektronikk/archive/; T. Farley, "Mobile Telephone History" at 7, web.archive.org/web/20040304011715/http://privateline.com/pcs/history7.htm. Navigant Consulting Inc., "Evolution of the Electric Industry Structure in the U.S. And Resulting Issues" (for Electric Markets Research Foundation, Oct. 2013) at 63 [40]. Public Utility Regulatory Policies Act (PURPA), Pub.L. 95–617, 92 Stat. 3117 (1978), 16 U.S.C. ch. 46 § 2601 *et seq.*

- Small residential customers with limited means, including those with low incomes, who cannot easily shift load, purchase EVs, or afford DG.

How should the balance among these competing interests be struck?

## 4. Finding the balance

The basic exchange of the regulatory compact is security for capital (opportunity to achieve reasonable return on capital prudently invested in and used and useful to public service) in exchange for universal service on just and reasonable terms. The need for regulation remains to protect equity and justice – and investors – and to find a reasonable balance between economic justice and environmental protection.

The US constitutional jurisprudence is more complex and nuanced (but beyond the scope of this paper). Constitutionally, for example, regulated utilities are protected against confiscation without "just compensation" by the Fifth Amendment, though this "has not and cannot be applied to insure values or to restore values that have been lost by the operation of economic forces." Market St. Railway Co. V. Railroad Commission of California, 324 US 548, 566 (1945). *See* Duquesne Light Co. v. Barasch, 488 US 299 (1989) (upholding application of the economic principle that rates be based on investment that is "used and useful"). Set against the utilities' constitutional protection, consumer protection is based on the wide latitude of the "end result"—"[t]he fixing of just and reasonable rates involves a balancing of the investor and the consumer interest."[83]

Over more than 100 years, regulatory systems have developed effective principles to manage that balance—lawyers call it precedent, which can be thought of as crowd-sourcing over time. To minimize costly mistakes, regulators usually move slowly and cautiously, hedging their bets. This includes retaining and applying tried-and-true regulatory principles to guide decisions and address transition issues such as the potential for death spiral. The principles are laid out in Section 2.2, above, and boil down to a principle of cost-based ratemaking, leavened by modest affordability supports and other considerations.[84]

Economic and technological conditions change in a century, of course, and regulation has adapted to changes in order to preserve the principles and balance of the regulatory compact. Electric utilities have aggregated a valuable set of technical, economic, and financial skills and assets that can continue to be usefully deployed in public service. They would not be the first to survive changing times and technologies, as International Telephone & Telegraph Co. wound up in the hotel business and Gas Light utilities distributing manufactured gas became gas heat utilities selling pipeline gas.

Clean DG may have important environmental benefits. However, it may also disrupt the balance of the regulatory compact by shifting consumption, and its associated revenue, from regulated utilities to other unregulated entities without commensurate reduction in utility costs. Rates for remaining units of consumption must rise to meet the demands of unchanged fixed costs, an impact that low-income households are particularly unlikely to be able to avoid. This challenges the regulatory compact in at least two ways: (1) utility investors' promised security is threatened, while (2) bills of low-income households increase beyond what is just, reasonable, or affordable.

DG at scale makes it difficult to reconcile the regulatory principles set out in Section 2.2. From one point of view, a system built for greater consumption must be paid for by ratepayers even though the system as built is no longer fully useful for the consumption that remains, is thus partially uneconomic, and resulting increases in rates are unaffordable for low-income households. Alternatively, investors must take losses, despite the unquestioned prudence and economics of the original investments.

The regulatory compact evolved to reconcile such dilemmas—to manage innovation, control rates, and achieve universal, affordable service. The compact has continuously evolved – for example, regulatory Integrated Resource Planning (IRP) developed in response to technological improvements in gas generation – and the entry of clean DG provides further opportunity for regulatory evolution to continue in order to capture the benefits of clean DG while mitigating its negative impacts.

The New York Public Service Commission Staff sets out a vision in which the regulated utility grid continues to provide value in the context of DG[85]:

> It is technically feasible to integrate energy-consuming equipment, as well as distributed generation and storage, fully into the management architecture of the electric grid. ... Such an architecture offers the potential of increased efficiency and reduced volatility in system management at both bulk and distribution levels, as well as reduced total consumption and greater penetration of clean and efficient technologies, with ensuing benefits in overall system costs, reliability, and emissions. It also offers the potential for customers to optimize their individual priorities with respect to resilience, power quality, cost, and sustainability. It is not intended to replace central generation, but rather to complement it in the most efficient manner, and to provide new business opportunities to owners of generation and other energy service providers.

The central point of this paper is that any evolution of the Regulatory Compact requires that equity be built in to any new design, maintaining the balance in the regulation of essential network services.

I therefore put out the potential regulatory approaches that follow for debate, not as policy prescriptions at this stage.[86] They will require management in the public interest. Participation and evolution must be continuous; regulators need well-funded protagonists on all sides. Regulation has evolved in its first century, and will con-

[83] Market St. Railway Co. V. Railroad Commission of California, 324 US 548, 566 (1945). *See* Duquesne Light Co. v. Barasch, 488 US 299 (1989) (upholding application of the economic principle that rates be based on investment that is "used and useful"). Federal Power Commission v Hope Natural Gas Co., 320 US 591, 603 (1944). *See generally*, J. Lazar et al., Electricity Regulation in the US: A Guide (Regulatory Assistance Project, 2011), including at 5–6 [31]; S. Hempling "What Regulatory Compact?" (Monthly Essay, March 2015) [24].

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[85] Staff, New York State Department of Public Service (NYS DPS), "Reforming the Energy Vision" at 8–9 (*in* New York Public Service Commission Case 14-M-0101, April 24, 2014), http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/26be8a93967e604785257cc40066b91a/$FILE/ATTK0J3L.pdf/Reforming%20The%20Energy%20Vision%20(REV)%20REPORT%204.25.%2014.pdf. For other views of the surviving grid, see T. Bosma et al., "Electrifying the Future" (DNV GL, Høvik Norway, 2014), http://www.dnvgl.com/Images/Electrifying_the_future_V1_tcm212-595433.pdf; [8]. J. Howland et al. "Energy Vision" (Environment Northeast 2014), http://www.env-ne.org/public/resources/ENE_EnergyVision_Framework_FINAL.pdf; [25]. Electric Power Research Institute (EPRI), "The Integrated Grid" (EPRI, Feb. 10, 2014), http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002002733&Mode=download.

[86] C. Livill et al., "Designing Distributed Generation Tariffs Well: Fair Compensation in a Time of Transition" (Nov. 2013) [34], J. Lazar et al., "Smart Rate Design for a Smart Future" (July 2015) [32]; J. Lazar, "Electric Utility Residential Customer Charges and Minimum Bills: Alternative Approaches for Recovering Basic Distribution Costs" (2015) [33]; A Faruqi et al., "Time Varying and Dynamic Rate Design" (n.d.).

tinue to evolve, but should not abandon to the marketplace social obligations such as those to the environment, economic justice (low income), service quality, and consumers.

Significant questions remain of scope and timing of change, not to mention the end state. If the grid survives, or remains in place during a long transition period, costs could be much greater than they are today, so there will still likely be a serious financial problem for small customers, especially those with low incomes. Among the difficult questions that have been raised, for example, are[87]:

- Who pays for transmission or distribution upgrades not needed by all?
- What happens when entrepreneurial risk comes to roost as utility losses due to investments that become uneconomic?
- How are consumers to be protected and the public interest to be managed?

The regulatory compact provides a structured process to democratically resolve such questions.

The policy goals of carbon reduction and technological innovation are important, even critical, but do not need to present an either/or choice. Caution is advisable before allowing the glitter of new technology to lead to the unravelling of protective regulation that has taken a century to develop democratically. Having taken a regulatory visit back to aspects of the roaring 1890s over the last 20 years or so, we need to come back to a modern world of universal service, just and reasonable rates, and adequate capital at fair compensation.

It should also be borne in mind that other developments will threaten affordability for low-income households and will therefore also need to be addressed. These include retirements of and modifications to inexpensive but polluting coal plants, development of central renewables, and electronics in the transmission and distribution systems that may provide real benefits that not all can afford. There are other price pressures as well, such as gas price volatility, the coming link to high world gas market prices, storm hardening costs, cybersecurity protection, and the possible loss of the low operating costs of nuclear power plants. For example, Massachusetts prices are projected to rise about 33–50%, which is 1.7–4.2% a year, primarily due to needed central generation and transmission capacity expansion.[88] Manitoba Hydro projects increases of 3.95% for each of most of the next 20 years, which will more than double rates.[89]

Possible current applications of the foregoing regulatory principles to DG include:

- If the democratic decision is to subsidize technologies that are kind to the planet, there are more equitable ways than ratepayer-financed transfers to provide subsidies, *e.g.*, government tax and grant policies that socialize costs through modestly progressive tax policy.
- Form cost-based rate classes for technologies such as PV, Electric Vehicle (EV), and special meters. For example, EV customers could be assessed for the specific costs of the infrastructure that uniquely serves them. Similar allocation rules could apply, for example, to equipment to handle two-way flows to better integrate DG as well as to data-handling costs of time-of-use rates and direct load controls.
- Bring back "value of service" pricing[90] as it was applied in the monopoly telephone industry, *i.e.*, maintain low prices for essential service by capping profits on them and setting prices above incremental cost based on perceived value for "luxury" services, as Touch Tone and Call Waiting were once considered to be. (This is different from the economists' definition of value of service pricing, or Ramsey pricing, prices based inversely on elasticity of demand.)
- Consider broader applications of the principle of universal service, such as low-income payments based on percentage of income, and universal affordable rollout of newly essential services, such as high-speed internet, based on the long-standing utility principle of average pricing to provide equity for high-cost areas.
- To the extent electricity service devolves toward a DG model and thus becomes more of an appliance, as heating systems are today, financing of the capital requirements for electricity service may be rolled into home mortgages. Arrangements may be needed for retrofits during a long transition. The Federal Housing Administration (FHA) mortgage insurance program[91] may be a model, though perhaps it would also be advantageous to take advantage of utility expertise via utility ownership. While the risks of utility investment (perhaps on a shared savings model similar to that applied to current energy efficiency investments) need to be carefully assessed, utility financial capability may outweigh perceived advantages of caution. Telephone utilities are a suggestive model (albeit with closer regulation than to date) as they have already morphed into mobile and internet providers (though they have the obvious business advantage of the continued need for networks of one kind or another).
- Indeed, ultimately, we may need to figure out how to finance and service low-income and consumer DG, which will be especially challenging for renters. We may need to reinvent weatherization and energy efficiency programs, too.

So what should be left of the social obligation of utilities? Tax-based subsidies for DG, rather than subsidies from ratepayers, payment for which can be avoided by shifting consumption off the grid. To maintain equity, an unavoidable systems benefit charge (tax) could also be assessed on all grid substitutes in order to maintain current and expanded social obligations. Such a "Systems Benefits Charge" would be imposed on consumers of the new technologies that are diverting the revenue that now supports social obligations, on the rationale that the sponsors and customers of the new technologies should share the social responsibility rather than play a game of regulatory arbitrage that leaves responsibility for social supports only to the legacy system. In an arguably similar manner, proposals to regulate (or even outlaw) Uber and similar taxi services are based on the analysis that unregulated taxi services derive some of their economic advantage by evading license fees, some taxes, insurance requirements, health and safety checkups, and fair wages—all potentially correctable by extension to Uber et al. of the same regulation to which its disrupted competition is subject.[92]

[87] Phil Dion at New Mexico State Center for Public Utilities, "Current Issues 2015," "Is the Regulatory Compact Still a Fair Deal?" panel (April 21, 2015).

[88] R. Hornby et al., "Incremental Benefits and Costs to New England of Large-Scale Hydroelectric Energy Imports" (Synapse draft memo to Mass. DOER, 2013) at 29–31, 37–38; clf.org/wp-content/uploads/2014/06/Synapse-Memo-Large-Scale-Hydro-12-31-13.pdf; see clf.org/blog/clean-energy-climate-change/governors-infrastructure-plan; C. Courchesne, "Three Ugly Numbers Behind the Governor's Push for Canadian Hydropower" (Conservation Law Foundation, 2014); clf.org/blog/clean-energy-climate-change/three-ugly-numbers-behind-governors-push-canandian-hydropower.

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[90] J.C. Bonbright, Principles of Public Utility Rates (New York: Columbia Univ. Press, 1961) at 379 *et seq* [3].

[91] *See* National Housing Act of 1934, P.L.73–479; P.L. 84–345, 69 Stat c. 783.

[92] K. Dervis, Is Uber a threat to democracy?" (Brookings, July 23, 2015), www.brookings.edu/research/opinions/2015/07/23-uber-democracy-dervis [13]; J. Sul-

Thus, if monopoly regulation is determined to be no longer desirable, essential utility services can still be publically overseen with least-cost and reliability among the goals.

An alternative approach to the same end would be a small tax on utility ratepayers (and perhaps also on DG customers) to support financing and operation of community DG (e.g., large solar farms) the output of which would be exclusively assigned to reducing the bills of customers identified as low-income. (Such transfers of DG output are often referred to as "virtual net metering.")

Mitigating climate change may be expensive. There are many – such as large customers as well as vendors of meters, transmission, and storage – with the economic incentive and ability (unless regulated) to transfer their costs to small residential consumers. But public policy should not address worldwide problems by requiring the poor to pay 26 cents per kWh so those who can afford DG investment can pay 12 cents.

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220 CMR 25, 27, 28, 29 (Mass.).

# 3

Applied Public Policy Research
APPRISE
Institute for Study and Evaluation

# PECO Energy
# Universal Services Program

## Final Evaluation Report

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This section uses the midpoint of these standards in presenting the number and percentage of CAP income-eligible households exceeding the "target energy burden."

For households with electric-only baseload service, the number and percentage presented includes those above 3.5 percent, 5.0 percent, and 6.5 percent, for the three groups (0-50%, 51-100%, and 101-150% of the federal poverty guidelines), respectively. For households with electric heating or combination electric and gas service from PECO, the targets are 10.0 percent, 13.5 percent, and 16.0 percent, respectively. For households with only gas service from PECO, the targets are 6.5 percent, 8.5 percent, and 9.5 percent, respectively.

Table II-11 displays the median energy costs and burden for all households with PECO residential service who were income-eligible for CAP. CAP income-eligible households with gas and electric service had annual energy costs of $2,710, while those with electric heat reported spending $1,453.

The mean expenditures for the CAP income-eligible households with electric-only baseload service (this includes households with neither gas nor electric heat from PECO) were $1,258. Annual costs for these households created a burden which exceeded the highest BCS target for electric-only service for over half of CAP income-eligible households.

**Table II-11**
**Distribution of Energy Bills and Expenditures for**
**CAP Income-Eligible PECO Households**
**By Service Status**

| Service Status | Number of Income-Eligible Households | PECO Energy Expenditures | | Median PECO Energy Burden |
|---|---|---|---|---|
| | | Mean | Median | |
| Electric-Only Baseload | 189,429 | $1,258 | $960 | 9% |
| Electric-Only Heating | 51,802 | $1,453 | $1,200 | 12% |
| Combination Gas and Electric | 45,009 | $2,710 | $2,280 | 17% |
| Gas Only | 462 | $1,601 | $976 | 6% |
| **All Households** | **286,702** | **$1,522** | **$1,098** | **10%** |

## *E. Characteristics of CAP Recipients*

Beginning in 2005, PECO used Department of Public Welfare (DPW) verified LIHEAP data to automatically enroll qualified customers into CAP. They continued to conduct this enrollment when income eligibility for LIHEAP in Pennsylvania was at or below the CAP eligibility limit of 150 percent of poverty. Therefore, PECO was able to automatically enroll customers in CAP in FY 2010, when the LIHEAP eligibility limit was 150 percent of poverty, but not in FY 2009 or FY 2011, when it was greater.

Table II-12 shows that the CAP program was serving nearly 139,000 PECO households by December 2011. This was down somewhat from nearly 142,000 in December 2010, possibility due to the change in LIHEAP eligibility. Most of the CAP customers were in CAP Tier D (46% in 2011) and Tier E (33% in 2011). However, there were over 30,000 in CAP Tiers B and C, for customers with income below 50 percent of the poverty level.

**Table II-12**
**Beginning-of-Year CAP Participants**
**By CAP Rate Tier**

| CAP Tier | Electric CAP | | | | Combination CAP | | | | Total CAP (including gas only) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | | 2009 | 2010 | 2011 | | 2009 | 2010 | 2011 | |
| A | 33 | 46 | 58 | 0% | 12 | 5 | 14 | 0% | 45 | 51 | 73 | 0% |
| B | 9,561 | 8,684 | 9,905 | 9% | 1,835 | 1,601 | 1,630 | 7% | 11,430 | 10,306 | 11,565 | 8% |
| C | 16,273 | 16,580 | 15,509 | 14% | 2,699 | 2,815 | 2,700 | 11% | 19,015 | 19,425 | 18,235 | 13% |
| D | 52,278 | 54,378 | 25,263 | 22% | 9,102 | 9,302 | 4,001 | 17% | 61,513 | 63,794 | 29,298 | 21% |
| D1 | | | 29,231 | 25% | | | 5,316 | 23% | | | 34,620 | 25% |
| E | 30,620 | 36,183 | 20,277 | 18% | 8,206 | 11,653 | 5,599 | 24% | 38,957 | 48,045 | 25,981 | 19% |
| E1 | | | 14,558 | 13% | | | 4,360 | 18% | | | 18,972 | 14% |
| **Total** | **108,765** | **115,871** | **114,801** | **100%** | **21,854** | **25,376** | **23,620** | **100%** | **130,960** | **141,621** | **138,744** | **100%** |

## *F. CAP Participation Rates*

Overall, 46 percent of eligible households participated in PECO's CAP in 2009. Approximately 131,000 PECO customers participated in the CAP program, while 287,000 PECO customers were eligible for some level of CAP benefit.

Table II-13 describes the participation rates for each CAP rate tier. CAP program participation was lowest amongst households with income below 25 percent of the poverty level. Twenty-five percent of eligible households with annual income below 25 percent of the federal poverty guidelines participated in the CAP; however, 65 percent of households between 25 percent and 50 percent of the federal poverty guidelines, and 63 percent of households between 50 percent and 100 percent of the federal poverty guidelines participated in the CAP.

**Table II-13**
**Participation Rate**
**By Poverty Level**

| Poverty Level (Cap Tier) | 2009 CAP Participants | CAP Eligible PECO Residential Households | Participation Rates |
|---|---|---|---|
| 0% -25% (A,B) | 11,475 | 45,505 | 25% |
| 26% -50% (C) | 19,015 | 29,440 | 65% |

| Poverty Level (Cap Tier) | 2009 CAP Participants | CAP Eligible PECO Residential Households | Participation Rates |
|---|---|---|---|
| 51% -75% (D) | 61,513 | 41,975 | 63% |
| 76%-100% (D1) | | 55,390 | |
| 101%-125% (E) | 38,957 | 58,118 | 34% |
| 126% - 150% (E1) | | 56,274 | |
| **Total** | **130,960** | **286,702** | **46%** |

Participation rates for electric and gas customers were quite similar. Table II-14 shows that 22,000 of 45,000 eligible gas customers received CAP benefits and 131,000 of 286,000 eligible electric service customers participated in CAP.

**Table II-14**
**Participation Rate**
**By Service Type**

| Service Type | 2009 CAP Participants | CAP Eligible PECO Residential Households | Participation Rates |
|---|---|---|---|
| Electric | 130,619 | 286,240 | 46% |
| Gas | 22,195 | 45,471 | 49% |

Table II-15 describes the participation rates for CAP eligible households that were identified as having energy burdens greater than targets set forth by the BCS. CAP program participation for targeted households was lowest amongst households with income below 25 percent of federal poverty guidelines. Twenty-five percent of eligible households with annual income below 25 percent of the federal poverty guidelines participated in the CAP, while 67 percent of targeted households between 25 percent and 50 percent of the federal poverty guidelines participated in the CAP.

Table II-15 also shows that more than 100 percent of targeted households between 100 percent and 150 percent of the federal poverty guidelines participated in the CAP. This may result from the structure of PECO's CAP program, which does not target customers by energy burden. Consequently, many CAP participants, especially those in higher poverty groups, may participate in CAP despite having energy burdens that fall below the PUC targets.

**Table II-15**
**Participation Rate for Targeted Households**
**By Poverty Level**

| Poverty Level (Cap Tier) | 2009 CAP Participants | CAP Eligible PECO Targeted Residential Households | Participation Rates |
|---|---|---|---|
| 0% -25% (A,B) | 11,475 | 45,423 | 25% |

| Poverty Level (Cap Tier) | 2009 CAP Participants | CAP Eligible PECO Targeted Residential Households | Participation Rates |
|---|---|---|---|
| 26% -50% (C) | 19,015 | 28,195 | 67% |
| 51% -75% (D) | 61,513 | 31,740 | 93% |
| 76%-100% (D1) | | 34,701 | |
| 101%-125% (E) | 38,957 | 20,670 | 109% |
| 126% - 150% (E1) | | 15,146 | |
| **Total** | **130,960** | **175,875** | **74%** |

Table II-16 displays participation rates for both electric and gas customers who had energy burdens that exceeded the BCS targets. The table shows that 74 percent of targeted electric customers and 85 percent of targeted gas customers participated.

**Table II-16**
**Participation Rate for Targeted Households**
**By Service Type**

| Service Type | 2009 CAP Participants | CAP Eligible PECO Targeted Residential Households | Participation Rates |
|---|---|---|---|
| Electric | 130,619 | 175,741 | 74% |
| Gas | 22,195 | 26,194 | 85% |

Table II-17 shows that PECO has higher CAP participation than other electric utilities in Pennsylvania. Using ACS estimates on the number of households in Pennsylvania with income at or below 150 percent of the FPL and data reported to the PUC on the number of households served by electric utilities in December 2009, we estimated that 46 percent of PECO households who were income-eligible received CAP benefits, while only 25 percent of income-eligible households in other utilities' service territories participated in CAP.

**Table II-17**
**Participation Rates for Pennsylvania Electric Utilities**

| Service Type | CAP Electric Service Households | CAP Income Eligible Households | Participation Rates |
|---|---|---|---|
| PECO | 130,619 | 286,240 | 46% |
| Other Electric Utilities | 150,066 | 589,883 | 25% |
| **Total** | **280,685** | **876,123** | **32%** |

Table II-18 shows that CAP participation was also higher for households receiving gas service from PECO than for those served by other gas utilities in Pennsylvania. The PECO gas CAP participation rate was 49 percent, compared to 37 percent for other gas utilities.

# 4

# PECO Energy Company
# Second Amended
# Universal Services
# Three-Year Plan
# 2013 to 2015

**Prepared by:**
**Patricia King**
**Manager, Universal Services**
**Originally submitted – February 28, 2012**
**Re-submitted – April 16, 2012**
**Re-submitted – May 6, 2013**

PECO Energy Company
Universal Services
Three-Year Plan
2013 – 2015
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**PECO's Three-Year Plan for 2013-15 has been edited to comply with the Commission's April 4, 2013 Order in PECO's Three-Year Plan Proceeding, Docket No. M-2012-2290911 (the "April 4, 2013 Order").**

# I. INTRODUCTION

The Universal Services' programs offered by PECO Energy Company *("PECO" or "the Company")* are designed to assist low-income residential customers receive the continued provision of the service in exchange for reduced monthly payments based on total household size and gross income. The Company's Universal Services' staff identifies low-income residential customers and provides them with reduced utility payments and access to other private and public resources.

PECO has a rich history of supporting local, community-based organizations (*See Attachment A*) and providing needed services to its low-income customers. PECO is pleased to submit the following Universal Services Plan for 2013 - 2015 in accordance to 52 Pa. Code §54.74.

PECO's Customer Assistance Program (CAP) began in 1984 in which all participants paid one set minimum charge each month. Twelve years later, by 1996, PECO had enrolled approximately 30,000 customers into CAP. During 1996, PECO also implemented a new pilot CAP Rate, initially limited to 10,000 customers, in which participants would be placed into various rate discount tiers based upon their household income levels. By early 1998, the pilot CAP Rate became fully subscribed up to the 10,000-customer limit. As part of its 1998 Electric Restructuring Settlement, PECO transferred 30,000 customers from the CAP program that incorporated one set monthly charge to the CAP Rate tiered program and expanded participation on an "open enrollment basis" to those who qualified with an "initial maximum participation level" of 100,000. Participation in the tiered CAP Rate program grew to about 83,000 customers by March 2000. In that month, PECO also entered into the PECO/Unicom Merger Settlement, in which it agreed to continue the CAP Rate as an "open enrollment program" with a "provisional maximum participation level" of 125,000. Under the terms of the PECO/Unicom Merger Settlement, PECO would recover $383 per customer, in excess of 90,000 electric CAP Rate customers and $200 for each gas CAP Rate customer in excess of 17,500, through its Universal Service Fund Surcharge. By 2005, CAP Rate participation increased to approximately 103,000 customers, making PECO's program the largest Universal Services program in Pennsylvania.

In 2003, further modifications to PECO's CAP Rate were made pursuant to PECO's petition for approval of consensus modifications to its Universal Service Program. The Pennsylvania Public Utility Commission ("Commission" or "PUC") approved the consensus modifications (Consensus Plan) at Docket Nos.: R-00027870, M-00001418 (Order Entered April 8, 2003). The Consensus Plan added three new levels to PECO's CAP Rate for customers with total household gross income levels at or below 50% of the Federal Poverty Level (FPL). The three levels (CAP Rates A, B and C) were

implemented in 2004. Under the terms of the Consensus Plan, an independent evaluator was charged with: (1) evaluating whether the Company's CAP Rates provide an affordable payment consistent with the Commission's Policy Statement, (2) analyzing energy burdens as a percentage of household income and (3) reviewing the effects of the modifications in the Consensus Plan. The independent evaluation was completed May 1, 2006. In that report, the independent evaluator rated PECO's Universal Services' programs as follows:

- LIURP – Excellent;
- CAP Rate – Very Good;
- MEAF – Satisfactory; and
- CARES – Satisfactory

The evaluation is required every 6 years and PECO submitted its second program evaluation in August 2012.

In 2008, PECO made two significant enhancements to its CAP program. First, in PECO's Gas Base Rate proceeding at Docket No. R-2008-2028394, PECO agreed to expand its gas CAP Rate program into a four-tier program with discounts applied to the full natural gas bill, rather than to just the distribution portions of the natural gas bill as had previously been the case. Greater natural gas discounts were also negotiated. Second, in PECO's 2007 – 2009 Three-Year Plan proceeding at Docket No. M-00061945, PECO agreed to make significant enhancements to its electric CAP program.

Effective January 1, 2011, as a result of the Petition of PECO Energy Company for Approval of Its Default Service Program and Rate Mitigation Plan (DSP) case (Docket No. P-2008-2062739), PECO introduced 2 new CAP electric and 2 new CAP gas tiers - CAP tiers D1 and E1, which are more targeted to benefit specific income levels. The 7 new electric and gas CAP tiers replaced the old 5 and 4 CAP tiers respectively. The additional two CAP Rate tiers address affordability via a more targeted discount by reducing FPL ranges from 50 percentage points to 25 percentage points in CAP Rates D & E (i.e. *the former CAP Rate D was 51%-100% and is now 51%-75% for the new CAP Rate D and 76%-100% for CAP Rate D1. Similarly, the former CAP Rate E was 101%-150% and is now 101%-125% for the new CAP Rate E and 126%-150% for CAP Rate E1).*

PECO's Universal Services Program contains six components

- Customer Assistance Program (CAP) Rate
- Low Income Usage Reduction Program (LIURP)
- Matching Energy Assistance Fund (MEAF)
- Customer Assistance and Referral Evaluation Services (CARES)
- Education-Outreach Programs
- External Grant Program Administration (e.g. LIHEAP)

As with all aspects of its operations, the Company is continuously looking for opportunities to improve or optimize its efforts. PECO's commitment to the six

components of Universal Services is well established and evident in its business operations:

- PECO has continued to streamline the CAP enrollment process and enhance the CAP outreach program. Currently, participation in the PECO CAP Rate program had increased to approximately 137,000 customers adding more than 100,000 customers over the past 16 years.

- PECO has continued to make investments and refinements to its CAP call center operations. These enhancements have improved fax and mail capabilities as well as processing and response time.

- PECO will offer a payment agreement for all LIHEAP crisis customers regardless of payment agreement eligibility.

- PECO has reached more low-income customers through outreach to state and local agencies PECO also increased the total number of LIHEAP grants available for its customers to over $20 million in three consecutive years (*LIHEAP Funding Year 2009, 2010 and 2011*). While federal funding for LIHEAP is subject to change annually, PECO is committed to helping customers leverage the available LIHEAP benefits. Pending changes to the federal allocation of LIHEAP in the federal budget, PECO anticipates customers continuing to receive more than 6% of the Pennsylvania share each LIHEAP season.

- The Company continues to explore and develop opportunities to improve efficiencies in program operations. Such efficiencies help increase customer participation and satisfaction. One such efficiency has resulted from coordinating with the Department of Public Welfare ("DPW") and using DPW data to identify and verify CAP Rate program eligibility and participation. By using DPW data, PECO can enroll and re-certify more customers into CAP Rate. PECO will continue to use DPW data via LIHEAP grants to enroll and recertify customers into CAP, however, As directed by the Commission's April 4, 2013 Order (p. 52, concluding paragraph 4), PECO will modify that process to ensure customers who are enrolled into CAP for the first time are informed of the benefits and responsibilities of the CAP program via a 60-day income verification CAP enrollment process.

One of the barometers PECO uses to validate its performance relative to Universal Services is the Universal Services Advisory Committee (USAC). The USAC was established to provide PECO with guidance and feedback during the implementation and subsequent expansion of the Universal Services programs, in particular the expansion of the state-approved LIURP program. The USAC meets four times per year to review program information and provides PECO with feedback on program performance and customer impacts. PECO considers recommendations from the USAC when making policy and procedural changes.

## II. NEEDS ASSESSMENT

PECO utilizes data from the U.S. Census Bureau and its Customer Information System to determine the possible number of low-income customers in its service territory that may qualify for the Company's Universal Services programs.

According to the most recent (*2010*) U.S. Census data, approximately 325,000 households who live in PECO's service territory have income at or below 150% of the Federal Poverty Level (*FPL*) and 437,000 households have income at or below 200% of the FPL.

| PECO Service Territory Poverty Chart | | |
|---|---|---|
| **County** | **Households < 150% FPL** | **Households < 200% FPL** |
| Bucks | 25,000 | 39,000 |
| Chester | 19,000 | 30,000 |
| Montgomery | 34,000 | 52,000 |
| Philadelphia | 215,000 | 265,000 |
| Delaware | 32,000 | 50,000 |
| York[1] | 750 | 1,175 |
| **Total** | 325,750 | 437,175 |

Utilizing the 2010 U.S. Census data, the Company has a population of 437,000 households that may be eligible to receive LIURP, CARES or MEAF grants. These statistics represent 31% of PECO's total residential population that is eligible for all Universal Service Programs while 23% of PECO's residential customers may be eligible only for the CAP Rate[2].

[1] York County – The total population for York County is 166,600 households. PECO has 4,700 customers in York County. The total number of households at or below 150% FPL in York County is 26,823, or 16%. Of the 4,700 PECO customers in York County, 750 (or 16%) would be CAP Rate eligible. Using this same methodology, 1,175 or 25% households would be 200% FPL.

[2] Not all household in the table above are direct customers of PECO (i.e. apartment buildings), therefore, not all low-income households in the table above are eligible for PECO's CAP program.

## III. PECO's UNIVERSAL SERVICES DEPARTMENT

PECO has a full staff of experienced Universal Services' employees that have supported the Company's low-income programs since the first 3-year plan was submitted in 2002. PECO is also able to successfully administer Pennsylvania's largest Universal Services' program by using experienced vendor resources.

PECO's Universal Services department consists of 10 staff members, including the manager of Universal Services, analysts, program support representatives, and CARES administrators. A complete organization chart is found in Section VII.

Universal Service analysts act as leads in managing day-to-day operations of their assigned programs. The Universal Service program staff handles quality control and general program support functions, while the CARES administrators handle duties related to CARES.

PECO's Universal Services department manages the following four vendors / call centers - CAP Rate; LIURP Vendor; LIHEAP Hotline; and the MEAF Fuel Hotline.

**CAP Call Center:** The CAP Call Center handles low-income residential customer inquiries for the purpose of determining income eligibility, processing of applications, re-certifications, making referrals, dissemination of information and processing of payment arrangements primarily for CAP Rate. This call center is equipped to handle all aspects of PECO's Universal Service Programs and employs approximately 50 employees including supervisors, call consultants and back office personnel. CAP Call Center back-office personnel are responsible for processing CAP Rate applications received via fax, U.S. mail and internet via the Universal Services' website.

**LIURP:** is a usage reduction program that targets low-income residential customers who are identified as having high usage. The main source of identifying LIURP eligible households is through PECO's internal Customer Information Management System (CIMS). Additional streams of intake include direct contact from customers or by indirect referrals from a wide range of community based organizations and social service agencies. Referrals are also received from the CARES unit, which identifies high usage associated with medical conditions and / or treatment.

**LIHEAP Hotline:** PECO also manages its own LIHEAP Hotline. LIHEAP is an important tool in managing low-income energy assistance. The LIHEAP Hotline enables customers to get direct assistance with LIHEAP eligibility and completing their application. The LIHEAP Hotline has approximately 12 employees.

**MEAF Call Center:** is the intake center for all customers and CBO (Community Based Organization) contacts and inquiries related to MEAF enrollment and donations. This call center is partially responsible for solicitation and outreach for MEAF donor strategies. The PECO MEAF Call Center has approximately 6 employees.

## 1. CAP RATE

### A. Program Description

CAP Rate is a discounted, residential, tariff rate for PECO's low-income, residential customers, whose total household income levels are at or below150% of the FPL. A customer's past due balance amount does not factor into PECO's eligibility determination. Enrolling eligible customers into the CAP Rate program allows many customers to avoid service terminations and maintain consistent payment patterns.

PECO identifies potential CAP Rate enrollees through a variety of means such as, customer telephone inquires; when a customer receives energy assistance grants; referrals from community groups, other utilities or state agencies; public outreach sessions, community workshops and PECO or advocate-sponsored events for low income customers. After PECO identifies potential CAP Rate enrollees, its asks these customers if they are interested in receiving information about Universal Services programs, and provides information and applications to those who are interested.

Working with DPW, PECO established certain circumstances under which it would accept low income verifications performed by DPW and use them to enroll customers into the CAP Rate program. When the FPL requirements that are set for LIHEAP enrollment are equal to or less than the FPL requirements that are set for CAP Rate enrollment, PECO will rely upon income verifications already performed by DPW; otherwise referred to as "data of the commonwealth". When this circumstance exists, PECO will automatically enroll qualified customers into its CAP Rate program at the highest CAP Rate tier, currently CAP Rate E1. PECO will also mail a CAP acceptance notification letter to each new CAP Rate customer that is automatically enrolled into the program. The letter serves 2 purposes. First, it notifies the customer they are now enrolled in CAP Rate (*and explains what their responsibilities are for continued enrollment)*, and second, it encourages the customer to provide their total household proof of income to PECO, which helps ensure that they will be enrolled in the most affordable CAP rate for their specific total household gross income. As directed by the Commission's April 4, 2013 Order (p. 52, concluding paragraph 4), PECO will inform LIHEAP auto-enrollees who have not previously participated in PECO's CAP program of their rights and responsibilities under the CAP program. Those customers will be required to complete the enrollment process by making a positive statement that they wish to remain enrolled in PECO's CAP program and, to the extent not otherwise available to PECO, provide income and household size information. If such a positive statement to complete the enrollment process is not received by PECO within 60 days, the customer will be removed from CAP, and will be deemed not to have been enrolled in PECO's CAP program for the 60-day period.

## Residential Electric CAP Rates

***CAP Rate Overview effective January 1, 2013*** – CAP Rates and their associated discounts for the period effective January 1, 2013 are included in the charts below:

| CAP Rate | Rate | Months | Max Discount |
|---|---|---|---|
| **CAP Rate A** | | | $12 for the first 1,000 kWh |
| 0-25% FPIG | Non-heat | All months | Each kWh > 1000 kWh billed at CAP D Rates |
| (with special circumstances) | | | $30 for the first 2,000 kWh |
| | | October - June | Each kWh > 2000 billed at CAP D Rates |
| | | July – September | $30 for the first 1,000 kWh |
| | Heating | | Each kWh >1,000 billed at CAP D Rates |
| | | | |
| **CAP Rate B*** | Non-heat | Oct – May | 92% of first 650 kWh up to $100.91 |
| 0-25% FPIG | Minimum bill of $12 | June | 92% of first 650 kWh up to $100.91 |
| (no extenuating | | July – Sept | 92% of first 750 kWh up to $115.44 |
| circumstances) | Heating | Oct & May | 88% of first 650 kWh up to $85.46 |
| | | Nov - Apr | 88% of first 1,500 kWh up to $189.06 |
| | Minimum bill of $30 | June | 88% of first 650 kWh up to $96.53 |
| | | July – Sept | 88% of first 750 kWh up to $110.42 |
| | | | |
| **CAP Rate C*** | | Oct – May | 85% of first 650 kWh up to $93.24 |
| 26-50% FPIG | | June | 85% of first 650 kWh up to $93.24 |
| | Non-heat | July – Sept | 85% of first 750 kWh up to $106.66 |
| | | Oct & May | 76% of first 650 kWh up to $73.80 |
| | | Nov - Apr | 76% of first 1,500 kWh up to $163.28 |
| | | June | 76% of first 650 kWh up to $83.36 |
| | Heating | July – Sept | 76% of first 750 kWh up to $95.36 |
| | | | |
| **CAP Rate D*** | | Oct – May | 68% of first 650 kWh up to $74.59 |
| 51-75% FPIG | Non-heat | June – Sept | 68% of first 650 kWh up to $74.59 |
| | | Oct & May | 50% of first 650 kWh up to $48.56 |
| | | Nov - Apr | 50% of first 1,500 kWh up to $107.42 |
| | Heating | June – Sept | 50% of first 650 kWh up to $54.85 |

| | | | |
|---|---|---|---|
| **CAP Rate D1*** | | Oct – May | 61% of first 650 kWh up to $66.91 |
| 76-100% FPIG | Non-heat | June – Sept | 61% of first 650 kWh up to $66.91 |
| | | Oct & May | 37% of first 650 kWh up to $35.93 |
| | | Nov - Apr | 37% of first 1,500 kWh up to $79.49 |
| | Heating | June – Sept | 37% of first 650 kWh up to $40.59 |
| | | | |
| **CAP Rate E*** | | Oct – May | 36% of first 650 kWh up to $39.49 |
| 101-125% FPIG | Non-heat | June – Sept | 36% of first 650 kWh up to $39.49 |
| | | Oct & May | 4% of first 650 kWh up to $3.88 |
| | | Nov - Apr | 4% of first 1,500 kWh up to $8.59 |
| | Heating | June – Sept | 4% of first 650 kWh up to $4.39 |
| | | | |
| **CAP Rate E1*** | Non-heat | Oct - May | 19% of first 650 kWh up to $20.84 |
| 126-150% FPIG | | June - Sept | 19% of first 650 kWh up to $20.84 |
| | Heating | Full residential rate | 0% discount |
| | | | 0% discount |
| *CAP Rate B, C, D, D1, E, E1 customers who exceed the kWh noted are billed on the full Residential rate. | | | |

**Note: Electric Rates will be adjusted annually based on market prices**

## Residential Gas CAP Rates and Discount

PECO provides the following discounts in its natural gas CAP program effective 12/1/2012:

**CAP Rate A – Gas:**

| CAP TIER | FPL% | CAP Gas Residential & Gas Residential Heating Discount % | CAP Gas RATE (CIMS Rate Description) | Maximum Discount | Monthly Bill Minimum |
|---|---|---|---|---|---|
| CAP A | 0-25% (With Extenuating Circumstances)<br><br>Income Verification is required annually | 79% applied to total bill<br>*(Note: must pay at least the monthly minimum)* | CAP Option A Gas Residential Service | Total bill | $10.00 |
| | | | CAP Option A Gas Residential Heating Svc | Total bill | $25.00 |

**CAP Rate B – Gas:**

| CAP TIER | FPL% | CAP Gas Residential & Gas Residential Heating Discount % | CAP Gas RATE (CIMS Rate Description) | Maximum Discount | Monthly Bill Minimum |
|---|---|---|---|---|---|
| CAP B | 0-25% (Without Extenuating Circumstances)<br><br>Income Verification is required every two years | 79% applied to total bill<br>*(Note: must pay at least the monthly minimum)* | CAP Option B Gas Residential Service | Total bill | $10.00 |
| | | | CAP Option B Gas Residential Heating Svc | Total bill | $25.00 |

**CAP Rate C – Gas:**

| CAP TIER | FPL% | CAP Gas Residential & Gas Residential Heating Discount % | CAP Gas RATE (CIMS Rate Description) | Maximum Discount | Monthly Bill Minimum |
|---|---|---|---|---|---|
| CAP C | 26-50%<br><br>Income Verification is required every two years | 68% applied to total bill<br>*(Note: must pay at least the monthly minimum)* | CAP Option C Gas Residential Service | Total bill | $10.00 |
| | | | CAP Option C Gas Residential Heating Svc | Total bill | $25.00 |

**CAP Rate D – Gas:**

| CAP TIER | FPL% | CAP Gas Residential & Gas Residential Heating Discount % | CAP Gas RATE (CIMS Rate Description) | Maximum Discount | Monthly Bill Minimum |
|---|---|---|---|---|---|
| CAP D | 51-75%<br>Income Verification is required <u>every two years</u> | 29% applied to total bill<br>*(Note: must pay at least the monthly minimum)* | CAP Option D Gas Residential Service | Total bill | $10.00 |
| | | | CAP Option D Gas Residential Heating Svc | Total bill | $25.00 |

**CAP Rate D1 – Gas:**

| CAP TIER | FPL% | CAP Gas Residential & Gas Residential Heating Discount % | CAP Gas RATE (CIMS Rate Description) | Maximum Discount | Monthly Bill Minimum |
|---|---|---|---|---|---|
| CAP D1 | 76-100%<br>Income Verification is required <u>every two years</u> | 12% applied to total bill<br>*(Note: must pay at least the monthly minimum)* | CAP Option D1 Gas Residential Service | Total bill | $10.00 |
| | | | CAP Option D1 Gas Residential Heating Svc | Total bill | $25.00 |

**CAP Rate E – Gas:**

| CAP TIER | FPL% | CAP Gas Residential & Gas Residential Heating Discount % | CAP Gas RATE (CIMS Rate Description) | Maximum Discount | Monthly Bill Minimum |
|---|---|---|---|---|---|
| CAP E | 101-125%<br>Income Verification is required <u>every two years</u> | 0% applied to total bill<br>*(Note: must pay at least the monthly minimum)* | CAP Option E Gas Residential Service | Total bill | $10.00 |
| | | | CAP Option E Gas Residential Heating Svc | Total bill | $25.00 |

**CAP Rate E1 – Gas:**

| CAP TIER | FPL% | CAP Gas Residential & Gas Residential Heating Discount % | CAP Gas RATE (CIMS Rate Description) | Maximum Discount | Monthly Bill Minimum |
|---|---|---|---|---|---|
| CAP E1 | 125-150%<br>Income Verification is required <u>every two years</u> | Nominal 0% applied to total bill<br>*(Note: must pay at least the monthly minimum)* | CAP Option E1 Gas Residential Service | Total bill | $10.00 |
| | | | CAP Option E1 Gas Residential Heating Svc | Total bill | $25.00 |

**Note: Gas rates will be adjusted quarterly based on natural gas market prices**

## B. Eligibility Criteria and Program Requirements for CAP Rate

1. Eligibility Criteria: A customer with a verified total household gross income at or below 150% of the FPL is eligible for PECO's CAP Rate program. The CAP Rate discount is dependent upon the FPL tier of the household. There are 14 CAP Rates (*7 electric and 7 gas*) available to PECO's low-income customers.

2. Program requirements:

- Complete a CAP Rate application, or be previously approved through fuel assistance or state agency requirements
- As directed by the Commission's April 4, 2013 Order (p. 52, concluding paragraph 5), PECO will request but will not require a social security or ITIN number for the customer of record or any household member for purposes of enrollment into CAP.
- Provide proof of gross income for all household members. PECO may also consider the income of household members who have not reached the age of majority. As directed by the Commission's April 4, 2013 Order (p. 53, concluding paragraph 6), if a customer or any household member 18 years of age or older claims no income, the customer or household member must provide a statement demonstrating how they pay their monthly expenses.
- Customers with multiple accounts qualify for CAP Rate only at one premise
- Provide PECO permission to verify their income with state agencies
- Pay their CAP Rate bills on time and in full each month, or late charges will be assessed on past-due amounts and service may be terminated
- Participate in energy reduction and conservation programs offered by PECO (i.e. LIURP) if identified as high-usage per LIURP usage guidelines
- Currently, CAP customers can not have an alternative generation supplier. Starting in April 2014, CAP customers will be able to shop for an alternative electric supplier.
- Agree to re-certification for the respective cycle based on CAP rate tier (*every 2 years for CAP Rates B – E1 or every year for CAP Rate A*)
- CAP Rate customers are encouraged to apply for a Low Income Home Energy Assistance Program (*LIHEAP*) grant each LIHEAP season
- Report any change in household income to PECO right away

3. Application Process – In order to be considered for CAP Rate, the customer is required to complete an application process. The customer must provide PECO with permission to contact state agencies to verify income. PECO may use the Pennsylvania Department of Public Welfare (DPW), the Pennsylvania Department of Revenue and the Matching Energy Assistance Fund (MEAF) agencies for income verification. If the agency is unable or unwilling to verify the customer's income, then the customer must complete a CAP application which includes proof of household gross income. The income certification process is an integral part of the CAP Rate process. Due to multiple levels of discounts, it is imperative that the Company obtains accurate income information to enroll the customer in the most advantageous rate.

4. CAP Recertification: CAP Rate customers must re-certify their income eligibility and are informed of this during the initial intake process. Customers in CAP Rates B, C, D, D1, E and E1 must re-certify every 2 years. Customers on CAP Rate A must re-certify annually.

The re-certification process begins 30 days before a customer's 2 year CAP Rate anniversary. The customer receives a letter that they have completed 1 or 2 years, (*1-year for CAP rate A – 2 years for all other CAP rates*), of participation in the CAP program and income verification for re-certification is now required to remain on the program.

This initial letter informs the customer of documentation necessary to maintain eligibility. The customer must submit a completed CAP Rate application along with their total gross household income verification. The information requested on the application allows the Company to complete additional validation, if necessary, but more importantly provides accurate demographic data that is used to complete the yearly Annual Universal Services Programs and Collections Performance Report required by 52 Pa. Code §54.75.

For a customer who is due for re-certification and has received utility assistance such as LIHEAP, the customer's income information may automatically be validated if the utility assistance was based upon identical income parameters and if the income verification process of the agency or entity giving that other assistance is acceptable to PECO. The customer could then be re-certified and may not be required to provide a completed CAP Rate application.

When the customer responds to the initial re-certification letter, with complete documentation and remains eligible for CAP Rate, they will receive a letter confirming that the processes have been completed. This letter reaffirms the Universal Service program requirements and customer obligations.

If the customer responds with incomplete or inadequate information, PECO will send a letter requesting the missing information. The customer will continue to receive the CAP Rate until re-certification is complete, subject to the 45-day removal process described below.

If there is no response from the customer to the initial CAP re-certification letter, a second letter is sent 15 days later requesting the necessary income information and explaining the risk of being removed from CAP Rate.

If the re-certification process is not completed within 45 days after the re-certification date, the customer will lose the benefit of the CAP Rate discount. If that occurs, a CAP Rate removal letter will be mailed to the customer advising the customer they no longer qualify for CAP rate. The account will then be removed from the CAP Rate and returned to standard residential rates.

5. Pre-program Arrearages: PECO's Pre-Program Arrearage (PPA) component is a key element of the CAP Rate program. It is designed to achieve the goal of improving customer payment. PECO will forgive all pre-program arrearages (*the delinquency before your first time enrollment on CAP Rate)* if the customer pays his/her new, discounted CAP Rate bill on time and in full each month. The requirement to pay the bill monthly is intended to establish a positive payment history for the customer enabling them to remain current or out of the collection process. This process was enhanced in the Gas Base Rate case so that, beginning April 1, 2009, payments will count towards meeting the forgiveness goal on a twelve month pro rata basis. For each month in which the CAP customer pays their bill in full and on time, one-twelfth of their pre-program arrearage will be forgiven. The forgiveness component is intended to provide a fresh start for the customer and allowing the customer to begin timely payments under a reduced rate. A CAP customer will be eligible for preprogram arrearage forgiveness at the time of their initial enrollment only. As directed by the Commission's April 4, 2013 Order (p. 52, concluding paragraph 3), PECO will continue to apply 1/12$^{th}$ PPA forgiveness for payments received throughout the year on a month-to-month basis. PECO will also enable an enhanced forgiveness process for customers who are caught up on payments at the 12 month mark or beyond.

6. CAP Rate program arrearages: Every PECO customer is subject to PECO's credit and collection policy, which includes termination. CAP customers, pursuant to provisions in chapter 56.100 are not subject to termination between December 1$^{st}$ and April 1$^{st}$. Customers who accumulate CAP Rate program arrearages will be offered one payment agreement. Customers with payment agreements will be placed on a budget if they are in CAP tiers A, B or C. The budget payment is encouraged but not required for customers in CAP tiers D, D1, E & E1. If the customer experiences a decrease in household FPL such that they go down a CAP tier, they are eligible for another payment agreement each time they go down a tier. Also, if the customer is approved for a LIHEAP crisis grant, they will get another payment agreement regardless of payment agreement history.

7. Dismissal from CAP Rate: Customers may be dismissed by PECO from CAP Rate for the following reasons; over income guidelines, failure to meet program requirements, failure to accept program services, failure to participate in a LIURP audit, failure to complete the recertification process, fraud, theft of service, or other misappropriations of service.

8. Policies for Fraud, Theft of Service and Other Misappropriations of Service: PECO will conduct an investigation of any CAP Rate account if it becomes aware of the potential of fraud, theft of service or other misappropriations of service. In the course of reviewing CAP Rate applications for enrollment or re-certification, action may be taken to review potential fraud (*e.g., validate suspected occupants, investigate inconsistent household / demographic information provided during the application process, theft of service, "name-game", etc.*). As part of PECO's standard revenue protection practices, customer information may be analyzed for potential fraud. Fraud

includes, but is not limited to, misrepresentation of the customer's identity for the purpose of obtaining utility service or CAP Rate, misrepresentation of income or occupant information, tampering with PECO's equipment or otherwise obtaining service illegally. PECO will follow its normal practices for investigation of fraud, theft of service, and other misappropriations of service which may result in some or all of the following - back billing, removal from CAP and termination. Once an account is removed for fraud, application is denied, theft of service, or other misappropriations of service, the customer will not be eligible for CAP Rate for one full year from the time of removal. Customers will also be held liable for some or all of the following including account arrearages (*forgiven or not forgiven*) pre-program arrearages and related account collection fees. PECO views theft of service as a serious public safety issue. In cases of theft of service, the customer is placing both his/her household as well as the community at large in unsafe conditions. For this reason, PECO will not tolerate theft of service.

9. Enrollment Limits: There is currently no enrollment limit for the CAP Rate program.

10. Phase out of Rates RH (Residential Heating) and OP (Off Peak). PECO will phase out electric rates RH and OP for all customers, including CAP customers, over the next 2 years (2012 & 2013). To help our customers manage the change, the phase out will occur in 2 stages – 50% reduction in 2012 and 50% reduction in 2013.

To help manage the phase out for CAP customers, PECO proactively reached out to an independent evaluator – APPRISE to conduct an affordability study to determine the appropriate rates for CAP customers taking into account the 50% RH phase out that occurred on January 1, 2012. 1st quarter 2012 CAP rates were adjusted accordingly for those customers to ensure we continue to meet affordability targets. PECO conducted another proactive APPRISE study in December 2012 to determine the appropriate CAP rates for January 2013 which took into account the total phase out of rate RH in 2013.

The two proactive studies mentioned above are in addition to the annual study which is conducted every June to determine the appropriate rates for the next 12 month period.

CAP rate OP customers will see an average total bill increase of 5% in 2012 as a result of the phase out of rate OP.

11. CAP Rate A – As directed by the Commission's April 4, 2013 Order (p. 52, concluding paragraph 2), PECO will implement an on-going process to reach out to CAP B customers to notify them of their potential eligibility of CAP Rate A.

C. Projected Enrollment Levels

PECO's CAP Rate program remains an open enrollment program. For the purposes of this plan, PECO projects its CAP Rate enrollment levels will be:

| | |
|---|---|
| 2013 | 142,000 customers |
| 2014 | 144,000 customers |
| 2015 | 146,000 customers |

**D. CAP Rate Program Budget**

See Section VI on page 33 of this document

**E. Plans to use Community Based Organizations**

PECO will continue to utilize the service of the community-based organizations to promote its Universal Service CAP Rate programs. A list and description of the main community based organizations are listed in Attachment A.

**F. Explanation of any differences between this plan and previous 3 year plan**

Changes between this plan and the previous 3-year plan;

- Additional discounts are being offered, for both natural gas and electric CAP customers, pursuant to settlements in the Gas Base Rate case, the Three-Year Plan proceeding, and the DSP Settlement.
- Additional CAP tiers have been added to the natural gas CAP Rate and, post-2010, to the electric CAP Rate.
- CAP Rate customers who receive a LIHEAP grant, in years in which income eligibility for LIHEAP is equal to or less than CAP eligibility will be automatically enrolled into PECO's highest CAP Rate tier in existence at that time. As directed by the Commission's April 4, 2013 Order (p. 52, concluding paragraph 4), additional measures will be taken to ensure customers who are auto-enrolled in CAP for the first time are informed of the benefits and responsibilities of CAP
- References to LIURP Advisory Council have been updated to reflect Universal Services Advisory Committee.
- CARES "caseworkers" changed to "administrators" to reflect current titles.

- Currently, CAP customers can not have an alternative generation supplier. Starting in April 2014, CAP customers will be able to shop for an alternative electric supplier.

- As directed by the Commission's April 4, 2013 Order (p. 52, concluding paragraph 5), Social Security numbers will be requested, but are not required for either the customer of record or any household member
- As directed by the Commission's April 4, 2013 Order (p. 53, concluding paragraph 6), Proof of no-income for the customer of record or any household member 18 years of age or older will be required to fill out a form demonstrating "how they pay their monthly expenses"

- Customers who have multiple accounts can receive the CAP Rate discount at one premise only.

- In Policies for Fraud, Theft of Service and Other Misappropriations of Service Deleted section, removed following reference: "The customer will have the opportunity to provide proof that fraud, theft of service, and other misappropriations of service did not occur. If no proof is provided, the customer will be removed from CAP Rate." Reason – Customers can go through normal dispute process.

- CAP enrollment levels updated to reflect new projections for 2013-2015.

# 5

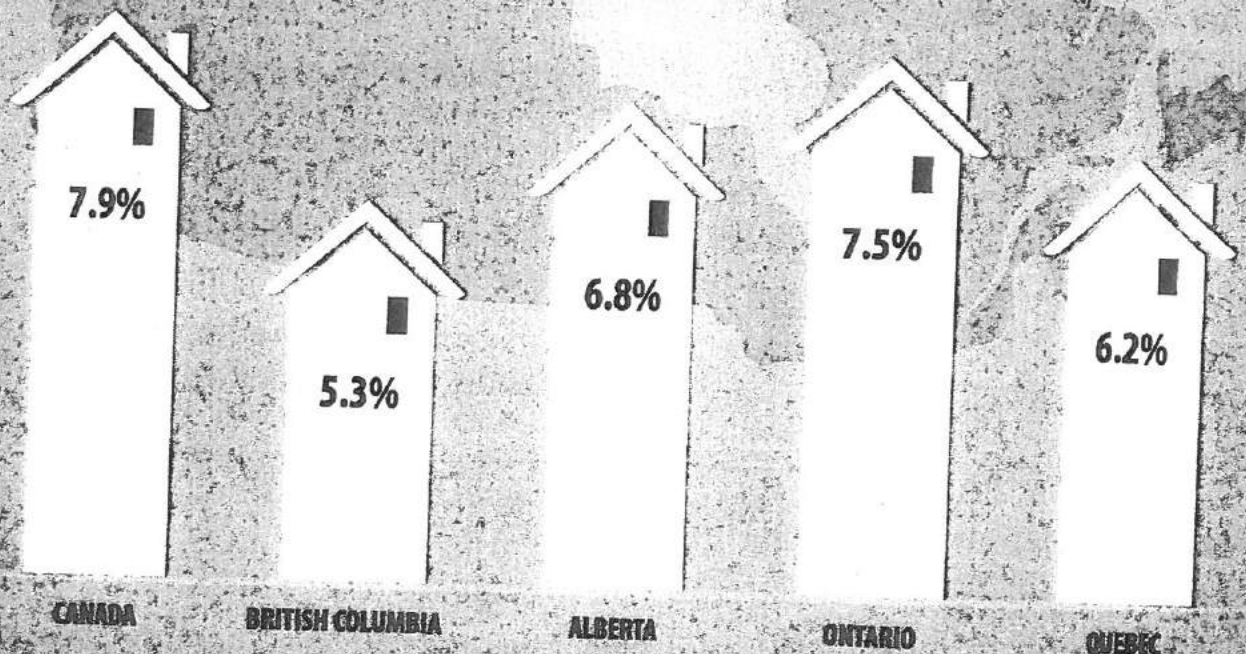
FRASER INSTITUTE

MARCH 2016

# ENERGY COSTS AND CANADIAN HOUSEHOLDS:

## HOW MUCH ARE WE SPENDING?

by Kenneth P. Green, Taylor Jackson, Ian Herzog and Milagros Palacios



# Energy Poverty and Canadian Households

In this section, we measure the incidence of energy poverty in Canada's provinces. First, we consider energy poverty where only within-the-home energy spending (electricity, natural gas, and other heating fuels) is included. We continue by re-estimating the incidence of energy poverty while including gasoline in the energy expenditure basket.

## Energy poverty from within-the-home spending only

**Figure 4** and Panel A in **table 3** contain estimates of the incidence of energy poverty in Canada using only expenditures for within-the-home energy spending. From 2010 to 2013, the share of households in energy poverty across Canada has risen slightly from 7.2% in 2010 to 7.9% in 2013. The peak over this four-year period came in 2012, when energy poverty in Canada reached 8.7%, an increase of more than 1.5 percentage points from the previous year.

### Atlantic Canada

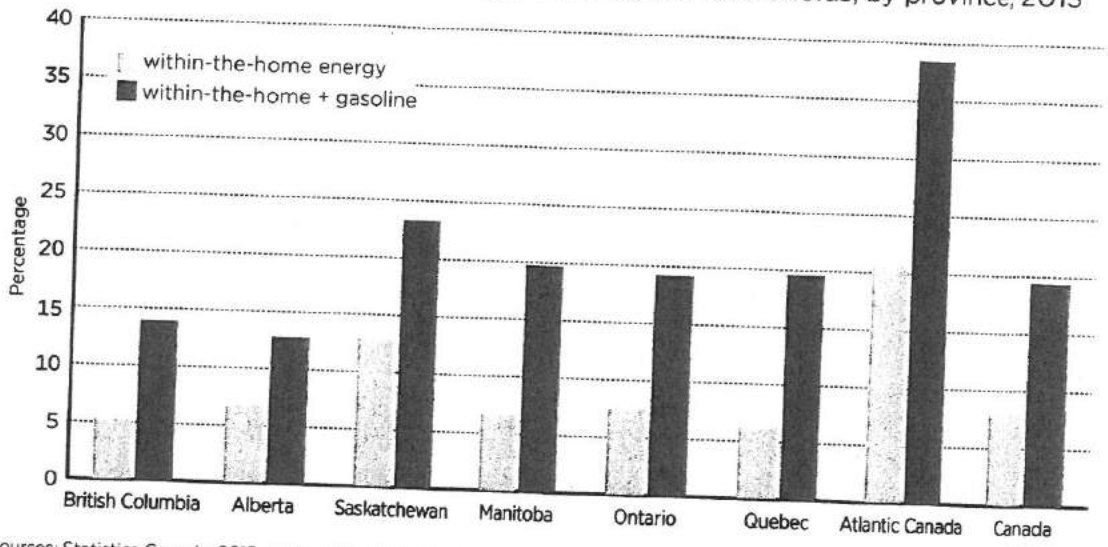
Atlantic Canada (an amalgamation of Newfoundland & Labrador, Prince Edward Island, Nova Scotia, and New Brunswick) has the highest incidence of energy poverty of any region in Canada in 2013, with 20.6% of households considered to be energy poor based on their within-the-home energy expenditures. [20] The incidence of energy poverty in Atlantic Canada has grown by over 20% since 2010, when 17.1% of households were energy poor.

### Saskatchewan

In 2013, Saskatchewan had the second highest percentage of households in energy poverty at 12.9%. This is still more than seven percentage points below

[20] Data for Atlantic Canada cannot be disaggregated by individual province because doing so would cause some data to be suppressed due to sampling.

Figure 4: Incidence of energy poverty, percentage of households, by province, 2013




Sources: Statistics Canada, 2015a; calculations by authors.

Table 3: Incidence of energy poverty by province (percent of households)

| | Panel A: Within-the-home energy | | | | Panel B: Within-the-home + gasoline | | | |
|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2010 | 2011 | 2012 | 2013 |
| British Columbia | 5.0% | 4.6% | 6.4% | 5.3% | 13.7% | 17.3% | 11.9% | 13.9% |
| Alberta | 5.6% | 5.9% | 8.1% | 6.8% | 15.8% | 17.9% | 14.9% | 12.8% |
| Saskatchewan | 13.3% | 11.9% | 10.7% | 12.9% | 27.0% | 27.6% | 27.5% | 23.3% |
| Manitoba | 6.0% | 6.5% | 6.9% | 6.7% | 20.7% | 22.1% | 13.1% | 19.7% |
| Ontario | 8.0% | 8.5% | 8.3% | 7.5% | 19.5% | 23.8% | 17.8% | 19.2% |
| Quebec | 4.4% | 4.0% | 7.7% | 6.2% | 15.6% | 20.5% | 17.2% | 19.6% |
| Atlantic Canada | 17.1% | 16.7% | 20.2% | 20.6% | 39.2% | 42.3% | 38.7% | 38.5% |
| Canada | 7.2% | 7.2% | 8.7% | 7.9% | 19.0% | 22.9% | 18.2% | 19.4% |

Sources: Statistics Canada, 2015a, custom tabulation from the 2010–2013 *Survey of Household Spending*; calculations by authors.

Atlantic Canada. In comparison to 2010, Saskatchewan's incidence of energy poverty has decreased slightly, although the 2013 measure is more than a percentage point above the period low in 2012.

### Ontario

Ontario also had a comparatively high incidence of energy poverty, with a 2013 measurement of 7.5% of households. While this number is high relative to other Canadian regions, it is a slight decrease from 2010, when the incidence of energy poverty was 8.0% in the province.

### Alberta

Alberta's incidence of energy poverty was in the middle of Canadian regions, with their 2013 estimate being 6.8%. The increase in energy poverty of 21.2% from 2010 in Alberta was the second highest in Canada in this period, behind only Quebec.

### Manitoba

Manitoba had a slightly lower incidence of energy poverty than Alberta. In 2013, 6.7% of households in Manitoba were considered to be energy poor based on their expenditures on within-the-home energy goods.

### Quebec

Quebec's incidence of energy poverty grew by over 40% from 2010 to 2013, reaching 6.2% in the final year. Even though Quebec saw a sharp increase, the province still had the second lowest level of energy poverty in 2013. Like other regions, energy poverty peaked in Quebec in 2012, falling by more than a percentage point in 2013.

### British Columbia

When focusing solely on within-the-home energy expenditures, British Columbia has the lowest incidence of energy poverty at 5.3% in 2013. This is almost a full percentage point below the next closest province Quebec. The relatively low levels of energy poverty in these provinces are likely to some extent the result of comparatively low electricity prices, driven by the provinces' substantial hydroelectric production (Angevine and Green, 2014).

## Energy poverty from within-the-home spending plus gasoline

**Figure 4** and Panel B in **table 3** include estimates of the proportion of Canadian households experiencing energy poverty when both within-the-home energy expenditures and gasoline are included between 2010 and 2013. In 2013, 19.4% of Canadian households devoted at least 10% or more of their expenditures to energy. This trend has been relatively consistent between 2010 and 2013. The incidence of energy poverty peaked in 2011 at 22.9% when gasoline prices rose sharply in that year.

### Atlantic Canada

Including gasoline expenditures, Atlantic Canada again had the largest proportion of households facing energy poverty in 2013 at 38.5%. Over the four-year period starting in 2010, Atlantic Canada has consistently had the highest share of its population in energy poverty.

### Saskatchewan

Saskatchewan follows Atlantic Canada with 23.3% of households being in energy poverty in 2013 when gasoline is included in energy expenditures. While Saskatchewan still has the second highest incidence of energy poverty with gasoline included, this inclusion shrinks the gap between Saskatchewan and other provinces.

### Manitoba

Manitoba is in the upper half of Canadian regions in terms of the percentage of households experiencing energy poverty when gasoline is included. In 2013, 19.7% of households were experiencing energy poverty using this measure. This is in contrast to the estimation of energy poverty using only within-the-home energy expenditures, where Manitoba ranked in the lower half.

### Quebec

Quebec's incidence of energy poverty is in the middle among these regions. In 2013, 19.6% of households in Quebec were energy poor. A recent report comparing electricity prices in North America noted that Quebec had some of the lowest electricity prices in Canada, likely driven by its abundance of hydroelectric generation (Angevine and Green, 2014). Indeed, when analyzing the percentage of the population that is in energy poverty based only on within-the-home energy expenditures, Quebec has the second lowest incidence of energy poverty in Canada, surpassed only by British Columbia. This suggests that the comparably high levels of energy poverty are possibly the result of other factors. That being said, when considering how energy poverty has changed from 2010 to 2013, Quebec experienced an increase of almost four percentage points in the incidence of energy poverty when gasoline is included, by far the largest of any region.

### Ontario

Ontario's incidence of energy poverty remained relatively consistent between 2010 and 2013, ending at 19.2%. Ontario experienced a spike in energy poverty (gasoline included) in 2011, along with other regions in Canada, likely caused by the large increase in gasoline prices in that year (see figure 1 above).

### British Columbia

Compared to the rest of Canada, British Columbia has a relatively low percentage of energy-poor households when gasoline is included, likely attributable to some extent to the province's abundant production of hydroelectricity, as seen when British Columbia incidence of energy poverty was estimated using only within-the-home energy (Angevine and Green, 2014). The mild climate that many of the province's residents experience may also contribute to low levels of energy poverty. In 2013, British Columbia's incidence of energy poverty reached 13.9%, a level similar to where the province was at in 2010.

### Alberta

When gasoline included in the calculation, Alberta has the lowest number of energy-poor households in 2013 at 12.8%. Since 2010, energy poverty has declined by just under three percentage points or 18.0%, the largest decline in Canada. Alberta's comparatively low gasoline prices during this period likely contributed to the lower level of total energy poverty (Natural Resources Canada, 2015b).

It is worth noting that the differences between provinces are not necessarily derived strictly from differences in energy costs. As noted above, there are three criteria that contribute to a within-the-home energy costs: prices, income, and efficiency. Electricity prices for example, are influenced by methods of electricity generation, which vary widely across Canada (Angevine and Green, 2014; McKitrick and Adams, 2014). In addition, temperature will be a factor in determining relative energy consumption levels. It is likely that variations in temperature and income contribute widely to the interprovincial differences observed above. However, a complete analysis of the reasons behind the regional variations is beyond the scope of this paper.

## Income and energy poverty

Previous research into energy spending found that low-income individuals tend to spend higher portions of their incomes on energy (Shammin and Bullard, 2009; Sovacool and Brown, 2010). We investigate this possibility, presenting estimates of the incidence of energy poverty by household income.

Figure 5 and table 4 present the percentage of households facing high energy costs in five income groups. [21] Energy poverty is inversely related to household income. The first and second groups ($27,000 or less; $27,000.01–$47,700) have the highest proportion of energy-poor households when results are calculated only on within-the-home energy and also when gasoline is included. In 2013, 30% of households in the first group and 28.8% in the second were spending more than 10% of their total expenditures on energy (including gasoline). Interestingly, when within-the-home energy (electricity, natural gas, and other heating fuels) only was considered, the second income grouping had a greater incidence of energy poverty than did the first.

The third income group ($47,700.01–$72,600) and the fourth ($72,600.01–$107,600) both experience relatively low levels of energy poverty

[21] Income groups were defined by sorting families from lowest to highest incomes (in inflation-adjusted dollars) from 1997 to 2009 using the SHS's public user microdata files (PUMF) sample. Each group contains 20% of all families over this time. These income groups were adjusted to reflect 2013 dollars and rounded to the nearest hundred.

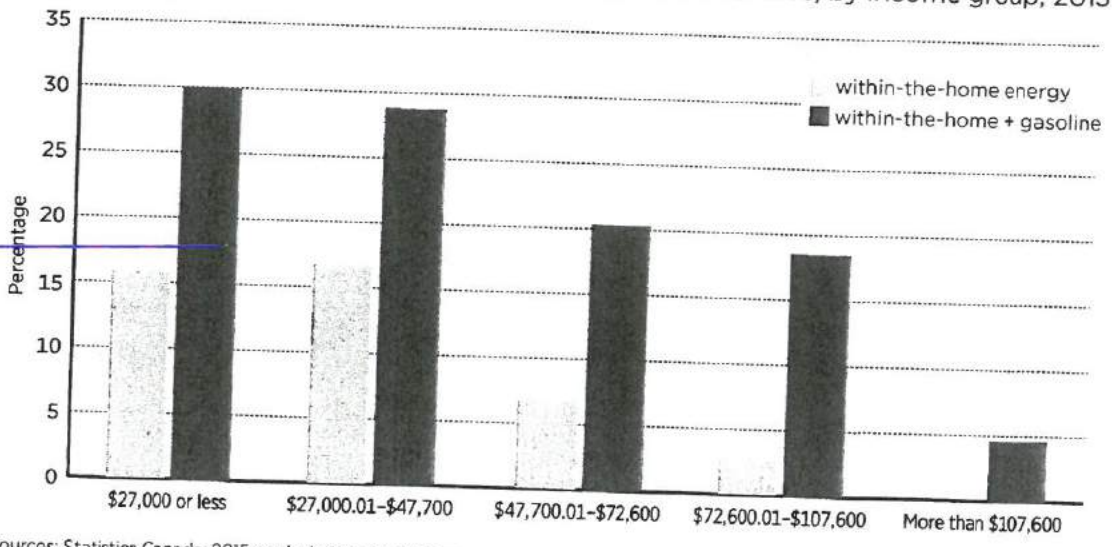
Table 4: Incidence of energy poverty by income group (percent of households)

| | Panel A: Within-the-home energy | | | | Panel B: Within-the-home + gasoline | | | |
|---|---|---|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | 2010 | 2011 | 2012 | 2013 |
| $27,000 or less | 16.9% | 18.3% | 19.3% | 15.8% | 28.5% | 28.5% | 23.5% | 30.0% |
| $27,000.01–$47,700 | 12.5% | 12.3% | 16.2% | 16.7% | 28.8% | 31.5% | 28.5% | 28.8% |
| $47,700.01–$72,600 | 5.7% | 4.9% | 6.3% | 6.9% | 20.1% | 29.3% | 22.9% | 20.3% |
| $72,600.01–$107,600 | 2.0% | 1.7% | 2.4% | 2.8% | 14.0% | 16.5% | 14.0% | 18.5% |
| More than $107,600 | — | — | — | — | 6.1% | 10.4% | 4.7% | 4.6% |

Note: "—" indicates data not available

Sources: Statistics Canada, 2015a, custom tabulation from the 2010–2013 Survey of Household Spending; calculations by authors.

Figure 5: Incidence of energy poverty, percentage of households, by income group, 2013




Sources: Statistics Canada, 2015a; calculations by authors.

when only within-the-home energy is considered. In 2013, the incidence of household energy poverty in the third and fourth income groups was 6.9% and 2.8%, respectively. Both groups saw increases from 2010 to 2013. When gasoline expenditures are included in the energy poverty estimates for these two groups, the incidence of energy poverty increases significantly (by more 13 percentage points for the third grouping and over 15 for the fourth), indicating that gasoline expenditures are likely a considerable component of these households' total expenditures.

In general, our analysis of Canadian data fits with research conducted abroad. We find that low income households are more likely to spend higher proportions of their expenditures on energy goods. An in-depth determination of the drivers of differences across income groups will require future research.