Evaluation of Low-Income Rate Designs

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Abstract

Human behavior is shaped by environmental factors. Evaluation of low-income payment programs is assisted by including two ecological variables that are generally not fully developed in formal program theory: the rate design and the socioeconomic context. The rate design governs the "please pay" amount on customer bills and so is likely to have a much stronger effect on results than other program variables. Similarly, socioeconomic context can make the difference between well-designed programs working well and failing. This analysis highlights the relative proportion of participants for which the formal program may have a prospect of success.

Depending on the specific situation, the rate design may be the central feature of the program, or it may be seen as completely separate from the program. In the first case, evaluation of low-income rate designs is formally central to the evaluation. In the second case, the rate design may still be the key factor in program performance, even if formally "off limits."

Introduction

As an introduction, a generic a low-income payment assistance program is first outlined along with typical outcome indicators and an evaluation model. In the next section of the paper, the basic set of low-income rate designs is presented, and an optimal design is distinguished. This is followed by discussion of socioeconomic context and trend. Two program evaluation examples are reported.

Low-Income Payment Programs

In generic terms, a low-income payment program is a program that offers some form of assistance in paying utility bills. There are several types of low-income payment assistance programs. At one extreme is a social work approach, which is never fully implemented though it is approximated by the case management approach. Many low-income payment assistance programs actively refer clients to other helping services (although very few maintain tracking systems on referrals or check results), and a number offer budget counseling. Most low-income payment assistance programs provide for a lowering of customer bills. Many provide some assistance with existing arrearage management as well current payment problems. At the other extreme, some programs are simply special low-income rates.

Performance is assessed on standard outcome measures (for example, net change in number of payments within a 12-month period, net change in percentage of bill paid over a year, net change in dollars paid over a year, and utility return on investment measures).

Evaluation is usually carried out using a comparison group design, with a baseline (pre-program) period and a program participation period over the same months in a succeeding 12-month period. This differs from a generic DSM program evaluation design in that only the baseline year and the participation year are required (24 months in all). In the comparable generic DSM evaluation there would be a baseline year, the treatment year, and the "post year" (36 months in all).

In both low-income evaluations and DSM evaluations changes in the comparison group are

subtracted from changes in the treatment group to develop net program impacts.

Low-income payment programs are typically underpowered. Such programs can be seen as indications that government and/or institutions (including utilities) care. They "point in the right direction." However, they lack the potential to meet need except for a small portion of participants. However, it is generally better to have a program than nothing at all. Underlying the poor performance of many low-income payment programs is the rate design lowers bills slightly (if at all) in relation to household need.[1] Programs that are embodied by such rate designs, or that have such rate designs as part of the background reality of low-income programs, can only be effective for a small portion of low and moderate income households. Two dimensions govern outcomes: the rate design and the socioeconomic context. These are discussed in turn, followed by two examples.

Rate Design

As summarized in Table 1, there are five basic low-income rate designs: (1) bill discounts (flat discounts and percentage of bill discounts), (2) inverted rates (with differing numbers of tiers and bill differentials among tiers, defined bill plans (budget billing and the flat bill), percentage of income payment plans (keyed in different ways to energy burden), and pre-payment plans. There are variants within these four types, and they can also be mixed to form hybrid designs.

Table 1: Basic Rate Designs.

RATE STRUCTURE	ILLUSTRATIVE EXAMPLE
Flat Discount	The bill is discounted by $3.00 each month.
Percentage of Bill Discount	The volumetric portion of the bill is reduced by 10% each month. The fixed portion is not adjusted.
Inverted Rates	The first block of energy is billed at a low rate, the second block higher, etc.
Budget Billing	Bills are at a flat figure, calculated based on an average of 12 months energy use
Flat Bill	The utility guarantees a flat bill and takes the risk if price escalates.
Percentage of Income	The bill is set at a fixed percentage of household income.
Prepayment Plans	Customers are required to purchase energy units in advance using a card system.

Bill Discounts

[1] Strict cost of service rate theory can work when markets work, but when households are not provided income sufficient to maintain an ordinary level of living through the job structure, transfer payments are required to insure they do not drop out of the market. When income transfer programs are damaged or absent, the only way to provide continuity of energy service is to employ payment assistance programs. The importance of examining the program implementation environment is discussed in discussed by Chen (1990: 117-140).

The flat bill discount is a simple rate design. It is applied to the general residential rate without affecting its structure, and provides a fixed discount of, for example, three dollars or five dollars per month. This design has the advantage that it direct transmits price signals – the more energy used, the higher the bill. The size of the discount is often too small to make much difference to payment troubled customers. However, it is important to remember that three dollars or five dollars is a significant amount to many low-income households.

The percentage of bill discount is similar but discounts a percentage of the volumetric portion of the customer bill. In practice, the discount structured as a percentage of bill usually result in a higher dollar discount than the flat bill discount. For example, ten percent of a $30 volumetric bill would match a three dollar flat discount, but if the volumetric portion of the bill were to be $60, the flat bill discount would remain at three dollars but the percentage of bill discount would be six dollars. An advantage is that this rate design transmits price signals – the more energy used, the higher the bill.

Inverted Rates

Inverted rates can be used to provide inherent discounts to low-income households while providing service at the standard residential rate. For example, if the first five hundred kWh per month is billed at three cents, the next 500 at five cents, and the remainder at fourteen cents, some minimal energy use is provided to all customers at a discounted rate. This design transmits price signals – the more energy used, the higher the bill, and it transmits with increased force of the signal as usage increases. Such rates encourage energy conservation. A disadvantage is that low-income homes are often older housing stock and tend to use substantially more energy than new efficient homes (such as Energy Star homes) even though the newer homes may be twice as large.

Defined Bill Plans

Most utilities offer budget billing, an overlay across any form of residential rate structure. Bills are averaged over a year and the customer is guaranteed billing at the average rate for a set period of time regardless of changes in price and usage. The generic equal billing plan will "true-up" once at year. Generally, low-income customers like the certainty of a defined bill. That is, knowing the size of the bill in advance has value separate from the size in itself. It is simpler to plan for a constant bill that will not reflect seasonal extremes in energy use. The disadvantage of this plan is that price signals are weakened, and the periodic "true-up" can present as rate shock condition if usage or commodity cost (or both) are rising rapidly.

In the Flat Bill approach, customers are guaranteed a flat bill amount for a defined period; for example, one year. The utility takes the risk of cost escalation which it may offset through financial instruments. This plan is generally appreciated due to the flat bill. Since it is a general rate design, it offers nothing to low-income customer beyond the certainty of a fixed bill, which tends to be valued by a low-income household. However, if the utility incurs cost, the flat bill is adjusted upwards at the end of a defined service period. This adjustment can induce rate shock if costs are rapidly rising.

Percentage of Income Plans

The percentage of income plan attempts to adjust bills to a percentage of household income. The advantage of this rate design is that it minimizes waste of resources. A disadvantage is that the price signal is removed. This approach has been implemented with a wide range of percentages in different utilities and

in different states.

Prepayment Plans

Prepayment Plans are a separate conceptual approach, and work as an overlay across any form of residential rate design. In this plan, low-income customers are required to purchase energy units on a card (similar to purchase of minutes on a prepay telephone card). The card is inserted in a device in the home that enables current to flow so long as there is prepay authorization on the card. Typically, these plans provide for a small amount of flexible usage beyond the end of the card authorization. The advantage of this plan is that payment problems are avoided since, by definition, energy cannot be used without pre-payment. Another advantage is that the system tends to focus customer attention on reducing energy use. A disadvantage is that the system hides health and safety problems due to rationing of energy service. Also, there can be problems for some households in getting out to a place that can recharge the card.

Combination Plans

Each approach to rate structure encompasses a wide range of variations. Percentage of bill discounts, budget billing, and prepayment plans are compatible as overlays with any rate structure. Further, it is possible to form hybrids of any of these rate designs. For example it is possible to use both a percentage of bill and percentage of income approach in a single rate design.

Optimal Design

Optimal rate design should meet three criteria: (1) the rate design should produce bills that that low-income households are able to pay. (2) The rate design should not provide more assistance than is necessary nor should it provide less than is necessary. That is, it should not fail to meet the needs of households and, at the same time, it should not provide assistance where assistance is not required. (3) The household should be required to pay what it can. Since the costs not paid by a low-income household are transferred to other customers, it is essential that households do what they can to make payments.

The third criterion is compatible with all of the rate designs. The second criterion is best met by the percentage of income plan. The first criterion is met through a rate structure that matches the "please pay" amount on bills to the socioeconomic situation of the household. The approach that does this best is the percentage of income plan. Each of the other rate designs can be made to approximate the percentage of income plan. The approximation using percent of bill is based on the creation of multiple tiers with different percent of bill requirements for the different tiers. By increasing the number of tiers, the percentage of income plan is approached as the mathematical limit which minimizes over assistance and under assistance.

Socioeconomics

Travelling across the United States and studying low-income payment programs in city after city and state after state, in assignments lasting from about one to about seven years, is an encounter with the realities of American life generally not as pictured in the media. Life for moderate income and low income families, especially families with children is getting increasingly harder. And, even upper income households are not doing particularly well unless they are in the upper five percent, or one-percent of households or higher.

Manufacturing employment in the US has been decreasing over several decades. That, in itself, speaks for the decline in good paying jobs, major migrations of population from former factory regions, and the deteriorated conditions for families and children who remain. The general quality of employment opportunities has been decreasing on average, with good opportunities for a declining portion of the population. Increasing income inequality brings increases in economic and social insecurity – an increase in fear. Increasing numbers of jobs do not pay a family wage. Benefits, if offered in employment, have been radically curtailed. In the kinds of jobs open to low-income households it takes approximately twice the labor hours to generate a level of income as it did in the middle 1960s. Over the past quarter century average wages have fallen when adjusted by inflation.

The inflation adjustments are, in themselves, misleading with the official statistics off by a factor of approximately two (that is, for example, each social security check should be twice its actual size).[2] Similarly the federal statistics on unemployment, employment, and poverty are also misleading. Real unemployment is always approximately double the reported unemployment, official employment only takes into account official labor time, but the employment numbers are not reported for jobs with a family wage, medical benefits, a pension, job security, and the realistic potential for advancement over a life career. Actual income insufficiency as measured using family budget studies consistently demonstrates need for assistance by households up to two and one half to below three and one half times the federal poverty level. These studies are now conducted in several states and evaluators can use them in policy evaluations.[3]

For many programs, it will not matter how hard the staff works or how committed the customers are to succeed. Low-income payment program evaluations must look closely at whether the program theory and logic diagram pass an elementary "straight face" test, given actual socioeconomics of households and the rate design.

We are experiencing a political economy of increasing immiseration. This fundamental change from the period from the end of World War II to about 1970 must be taken into account in evaluating programs. Also, that there is no change expected that could turn these secular trends around, and there are a number of crises ahead that look to intensify them.

Example 1: PECO Energy – Study of Customers from Zero to Fifty Percent of Poverty

In this example, the evaluation focused on a low-income payment assistance program designed specifically as a utility rate, the "CAP Rate" program at PECO Energy, which serves Philadelphia and the surrounding region. The Pennsylvania Public Utility Commission ordered a study to determine if a "safety net" or "special needs" component to an existing low-income payment assistance program was necessary. Specifically, the order states that "…based on the [prior] CAP Rate evaluation, PECO's CAP quarterly reports to BCS, and our review of BCS payment arrangement requests, we find that the CAP Rate may not comply with section 2802(10) of the Act for approximately 20% of CAP Rate customers who have low

[2] This is the difference between the amounts as calculated using the original method for the CPI and as officially calculated with cumulative hedonic and other special adjustments. See Williams, Walter J., "The Consumer Price Index, October 1, 2006 Update, http:/www.shadowstats.com/cgi-bin/sgs/article/id=343.

[3] For examples, see Pearce, Diana & Jennifer Brooks, "The Self-Sufficiency Standard for Pennsylvania, Summary Report." Swarthmore, Pennsylvania: Women's Association for Women's Alternatives: 1998. See also, Pearce, Diana & Jennifer Brooks, The Self Sufficiency Standard for Nevada, prepared for the Progressive Leadership Alliance of Nevada, 2002. In addition, see, "Working Hard, Living Poor, Part I: Nevada: Basic Needs and a Living Wage," A Report by the Progressive Leadership Alliance of Nevada, Susan Chandler, MSW, Ph.D., Project Research Director & Alicia Smalley, MSW, Research Assistant, August 2001 (Progressive Leadership Alliance of Nevada, www.Planevada.org).

incomes and high usage. The CAP Rate *simply may not be affordable* for this group of customers as required by section 2802(10) of the Act" (italics added).[4]

In carrying out this evaluation, we found that "PECO's present CAP is *not affordable for most customers* with incomes from 1-50% of the Federal Poverty Level." However, we found it affordable for customers toward the top of this income range who have minimal energy use. The basic finding was that "about 15% of current CAP 0-50% FPL participants currently have affordable electric bills under the low-income payment assistance program (CAP Rate)."

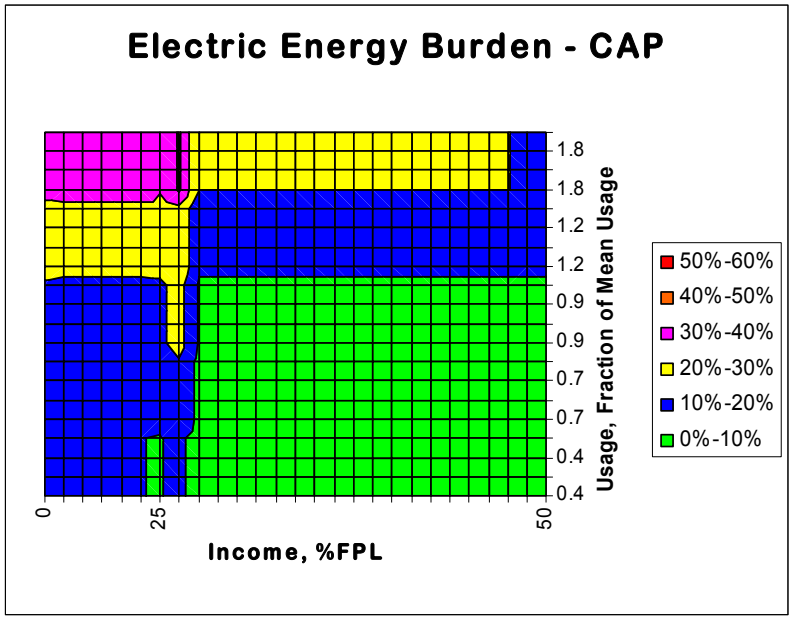

Figure 1: Map of Energy Burden, Households from 0 to 50% of Federal Poverty Level.

Figure 1 is a "sector map," showing actual household energy burdens, a low-income payment program evaluation tool that uses color on a grid to clarify regions in which the current rate design is working, and regions where it is not.[5] Each square in the grid represents 73 participant households, with a little over 36,000 program households represented, in all. The horizontal axis shows household income, expressed as a percentage of the federal poverty level (which takes into account both income and number of persons in the household) and for this graph ranges from zero to fifty percent of federal poverty level. Yearly electric energy burden is the percentage of household income required to pay for one year's energy use, in full. In this graph, developed using data from the company's customer information system, the vertical axis shows fraction of the average of residential electricity use, ranging from 0.4 to 1.8 times the average.

Figure 2 uses the same measurement grid, but shading is used to show squares in which households are presented with affordable bills. In this case, affordability is defined by the Pennsylvania Commission in terms of an acceptable energy burden. As shown (shaded area), only fifteen percent of households from zero to fifty percent of the Federal Poverty Level were being presented with affordable electricity bills.

[4] Docket No. M-00001418, PECO's Submission of Universal Service and Energy Conservation Plan in Compliance with Section 54.74, Order of September 28, 2000. "CAP Rate" is the name of PECO Energy's low-income payment assistance program, and "BCS" refers to the Commission's Bureau of Consumer Services.

[5] Sector Maps were developed by Howard Reichmuth, PE. The full set has approximately ten different maps.

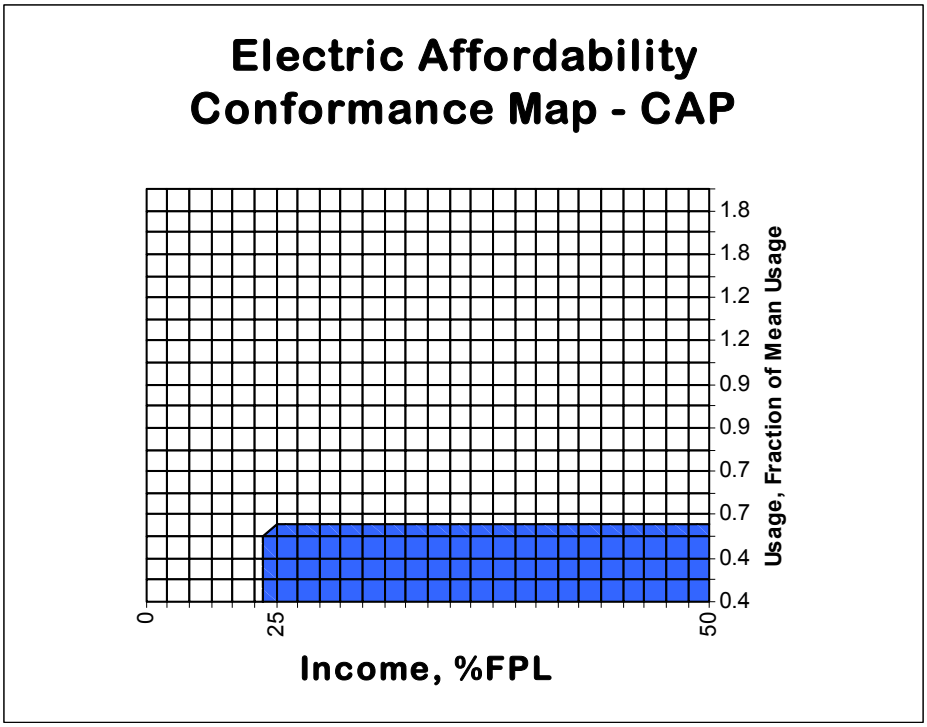

Figure 2: Map of Affordable Electricity.

After modeling a number of alternative rates, the evaluation team recommended a percentage of income payment design with special considerations. The new rate design resulted in 100% conformance to the affordability guidelines of the Pennsylvania Code, meaning that bills presented by the rate would be affordable to virtually all households with incomes from zero to 50% of poverty. The Company decided not to implement the recommended percentage of income payment, but developed a rate design that closely approximates the effects of the evaluation recommendation.

Under this rate design, customers with annual incomes at or below twenty-five percent of the federal poverty level with documented extenuating circumstances are offered a flat rate of $12 per month for the first 1,000 kWh with no fees, no penalties, and no extra charges. For customers in this group with electric heat, the flat rate is $30 per month which includes up to 2,000 kWh in winter months. Customers in this income range not eligible for the lowest rates (without extenuating circumstances) are provided with an 85% discount on the first 500 kWh per month year-around plus a 30% discount on the next 100 kWh during summer months. Customers with incomes above 50% of poverty but less than or equal to 150% are classed into additional tiers and receive smaller percentage discounts of 50% or 26% of the first 500 kWh per month, year-around.[6]

Example 2: Nevada's Universal Service Program

In August of 2007, the State of Nevada is in the sixth year of a low-income payment assistance program that is based on a percentage of income, and specifies the required participant payment of an amount for their household equal to the percentage median residential energy burden for households in the state. Each year, the Division of Welfare and Supportive Services recalculates the state median residential

[6] PECO Energy Company, Customer Assistance Program(CAP) Rider, Supplement 69 to Tariff Electric Pa. P.U.C. No. 3, Fourth Revised Page 68A, Third Revised Page 68B, Third Revised Page 68C, and Third Revised Page 68D.

energy burden using billing information supplied by the utilities and population data from the state demographer. The effect on required payment for all electric customers of Nevada Power is shown in Table 2.

Table 2: Sample of Nevada Universal Service Assistance for State Fiscal Year 2006.

Client ID	Electricity (kWh)	Annual Electric Bill	Annual Household Income	Electric Bill Assistance	Post Program Bill	Pre-Program Household Energy Burden	Post Program Burden	Assistance (Percentage of Total Energy Bill)
12643000	8684	804.75	7,584.00	551.00	252.55	10.61%	3.33%	68.47%
12811100	11587	1,068.19	18,006.04	468.00	599.60	5.93%	3.33%	43.81%
13911000	8450	791.47	8,208.00	518.00	273.33	9.64%	3.33%	65.45%
14031000	13737	1,275.30	10,112.38	938.00	336.74	12.61%	3.33%	73.55%
14219000	10106	966.24	8,368.56	687.57	278.67	11.55%	3.33%	71.16%
14224000	16856	1,570.98	6,948.00	1,339.00	231.37	22.61%	3.33%	85.23%
14415000	10958	1,007.20	9,960.00	675.00	331.67	10.11%	3.33%	67.02%
14609000	27607	2,577.00	36,885.50	1,349.00	1,228.29	6.99%	3.33%	52.35%
16136000	12346	1,151.94	17,373.72	573.40	578.54	6.63%	3.33%	49.78%
17307000	12147	1,117.04	12,408.00	704.00	413.19	9.00%	3.33%	63.02%
17522100	16050	1,527.12	10,248.00	1,185.86	341.26	14.90%	3.33%	77.65%
18814000	8952	748.72	8,796.00	455.00	292.91	8.51%	3.33%	60.77%
19154100	5019	470.78	3,802.50	344.16	126.62	12.38%	3.33%	73.10%
19332000	5202	482.07	7,620.00	228.00	253.75	6.33%	3.33%	47.30%
19471000	13614	1,272.53	6,000.00	1,072.00	199.80	21.21%	3.33%	84.24%
20010100	8963	831.59	5,592.00	645.00	186.21	14.87%	3.33%	77.56%
20934000	9367	857.16	1,608.00	803.61	53.55	53.31%	3.33%	93.75%
21022000	9239	860.13	7,476.00	611.00	248.95	11.51%	3.33%	71.04%
21270100	11859	1,119.82	25,656.00	265.48	854.34	4.36%	3.33%	23.71%
22168000	9050	828.17	12,576.00	409.00	418.78	6.59%	3.33%	49.39%
22521100	10091	958.35	9,840.00	630.68	327.67	9.74%	3.33%	65.81%
23930000	5080	467.48	7,384.80	221.00	245.91	6.33%	3.33%	47.27%
24834000	24061	2,243.46	14,280.00	1,767.00	475.52	15.71%	3.33%	78.76%
25312100	11662	1,076.36	16,188.00	537.00	539.06	6.65%	3.33%	49.89%
25358000	6028	554.19	9,708.00	231.00	323.28	5.71%	3.33%	41.68%
25370100	8450	791.47	7,236.00	550.51	240.96	10.94%	3.33%	69.56%
26197000	13865	1,284.87	4,420.00	1,137.68	147.19	29.07%	3.33%	88.54%
26277000	8451	773.35	9,708.00	450.07	323.28	7.97%	3.33%	58.20%
26985000	8640	793.98	1,344.00	748.00	44.76	59.08%	3.33%	94.21%
27949000	15954	1,459.95	10,152.00	1,121.89	338.06	14.38%	3.33%	76.84%

To date, the median energy burden has varied around three percent of household income. New Jersey has a similar program with the percentage energy burden set at six percent of household income. One way to understand why the Nevada approach is a best practice is to compare it to a utility discount approach. In general, utility discount approaches (using a flat utility discount, such as 10% or 20%) tend to distribute assistance dollars without regard to the specific socioeconomic situation of households. Further, the size of the assistance amount in bill discount program is generally inadequate to meet need for the lower income households.

In evaluating this program, the evaluation team reports on a program that is successful for a wide range of low-income and payment troubled customers because actual socioeconomic situations have been taken fully into account for customers below 150% of poverty, by the requirement to pay approximately three percent of household income plus the fixed portion of customer bills. This program is an overlay on

existing utility rates by a state universal service program, but it is essentially an intelligent rate design based on real-world economics of low-income households. The evaluation has recommended extending this type of approach to include households in need as measured using the family budget income inconsistency method.

Table 3 further illustrates the effect of rate design for state Universal Service Programs for a set of constant electricity and gas yearly energy bills across programs, beginning with "no program" energy burdens.

Table 3: Effects of Four Rate Designs.

No Program Energy Burden	Post-Program Nevada Energy Burden	Post-Program New Jersey Energy Burden	Post-Program California Energy Burden
52.12%	3.33%	6.00%	41.69%
7.65%	3.33%	6.00%	6.12%
15.54%	3.33%	6.00%	12.43%
10.77%	3.33%	6.00%	8.62%
6.30%	3.34%	6.00%	5.04%
10.42%	3.33%	6.00%	8.34%
9.56%	3.33%	6.00%	7.65%
13.39%	3.33%	6.00%	10.71%
6.37%	3.35%	6.00%	5.10%
8.85%	3.33%	6.00%	7.08%
19.98%	3.34%	6.00%	15.98%
13.67%	3.34%	6.00%	10.94%
6.54%	3.33%	6.00%	5.23%
17.02%	3.33%	6.00%	13.62%
11.54%	3.33%	6.00%	9.23%
18.47%	3.33%	6.00%	14.78%
17.54%	3.33%	6.00%	14.03%
13.67%	3.33%	6.00%	10.94%
86.02%	3.34%	6.00%	68.81%

Summary & Recommendations

Policy evaluations should be inclusive of contextual factors. For low-income payment programs, these include factors that influence ability to pay, including rate design and socioeconomic context. The basic recommendation for programs is that bills should be carefully designed to provide bills that households are able to pay without sacrifice of other necessities such as medicine, medical care, school costs, essential clothing, shelter, and child care, while the design should neither over-assist nor under-assist. In evaluating low-income payment assistance programs, the "sector map" (Figures 1 & 2) is a powerful tool for deriving and presenting answers to the research question of to what extent existing utility rate design presents bills that low and moderate income customers are able to pay. As discussed briefly in this paper, the rate design and the socioeconomic context are underlying factors in determining to what extent a payment assistance program works. Also, it is important to note that the federal poverty metric is not a good

indicator of income insufficiency, while family budget studies provide much better measurement. Generally payment assistance is required at a minimum for household at 250% of poverty and, depending of structure of the household, up to about 350% of poverty.

Rate design should generally be included in evaluation of low-income payment programs, and the real socioeconomic context rather than the "official" picture should be used.

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