Determinants of the Cost of Electricity Service in PCE Eligible Communities

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Executive Summary

This report is one of two companion reports ISER prepared for the Alaska Energy Authority. The other report, "True Cost of Electricity in Rural Alaska and True Cost of Bulk Fuel in Rural Alaska," is dated October 26, 2016. That report estimates the full costs of providing electricity in rural Alaska, including the costs of subsidies provided to lower the price consumers pay. This second report assesses how the costs of electric generation in Power Cost Equalization (PCE) communities are or might be affected by three factors that are not related to the differences in electricity generation costs. Those three factors are the organizational structures of utilities, postage stamp rate design, and managerial information available on energy subsidy programs.

1. Organizational Structures of Utilities

Electric utilities in PCE communities are organized as cooperatives, are run by local villages and municipalities, or are investor-owned utilities. The scale of these utilities varies widely, and includes regional utilities that manage separate electric grids in multiple communities. A review of those organizational structures indicates that:

1.1. There are significant differences in distribution, customer service, and general and administrative costs (DCG&A) across utilities. These differences are correlated with the utility size and organizational structure, with the smallest utilities having significantly higher DCG&A costs per kWh.

1.2. Small local utilities that have merged with larger regional utilities have benefited from reduced costs and professional management. Incentives to encourage small local utilities to join larger, more efficient regional utilities should be considered.

1.3. The cost of borrowing for large local and regional electric coops remains low compared with that for stand-alone local villages, municipalities, and investor-owned utilities.

1.4. The state government should consider allowing a return on equity as an allowable expense within the PCE cost of service [AS 42.45.110(a)] to enable utilities to build equity, enhance debt coverage and facilitate the expanded use of private capital, and reduce dependency on limited public capital resources. This private capital may take the form of investor capital for investor-owned utilities or member capital for cooperatives.

2. Postage Stamp Rate Designs

2.1. Postage stamp rate designs—a single rate for electricity for some set of customers—can help reduce costs and improve affordability in smaller, remote communities through an implicit cost subsidization from customers in larger communities.

2.2. The subsidies in postage stamp rates may decrease incentives for utilities to manage their costs, because higher costs may be subsidized by postage stamp rate-making.

2.3. The increase in cost in subsidy-providing communities risks inefficient bypass by large commercial or government users. This could increase the total cost of electric service and leave the remaining customers with higher rates and diminished affordability. Separating communities into rate groups according to their cost structure may mitigate, but not eliminate, the risk of self-generators bypassing the local electric utility.

3. Efficiency in Governance of Energy Subsidy Systems

3.1. To assess whether the PCE program is achieving its goals, transparent information about the allocation of the subsidies and about the operation of the subsidized utilities is required. The companion report to this one identified some issues about reliability of information generated under the current reporting system. Improvements in the reporting requirements could address these issues. A common issue is inconsistency in accounting for capital that state and federal agencies contribute to utilities. Those capital contributions include both grants or low-interest loans to finance capital projects as well as sources of short-term government financing, such as annual fuel loans, emergency loans, and write-offs of operating loans for troubled utilities. If capital investments for generation were separated from other capital, investments to reduce fuel costs (such as wind power) could be assessed more directly.

3.2. The PCE program is one of several programs that subsidize energy costs in rural Alaska, and an understanding of the interaction among these programs is required. An annual compilation of all state and federal heating and electrical subsidy support systems by community would enable better understanding of both individual program impact and also the collective programmatic impact of the subsidies on energy affordability.

3.3. Information on system reliability, usually measured as outage hours, is required to fully assess utility performance.

3.4. Currently, there is no information on how well the PCE program and other energy subsidy programs in rural Alaska target families and communities that face the greatest energy affordability challenges. Because of limitations on income data in small rural Alaska communities, assessing how well subsidies are targeted may be challenging. However, in light of general information that energy subsidies are often inefficient at poverty reduction, this is an important question.

3.5. The environmental impact of energy subsidies for rural Alaska, including the PCE program, through CO_2 emissions and PM 2.5 emissions, has not been assessed.

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I. Background

Alaska has provided significant funds to help reduce the burden of energy costs in rural Alaska. Under the Power Cost Equalization (PCE) program, the cost of the first 500 kWh of electric usage by residential customers may be subsidized by the funds from the PCE Endowment, if certain criteria are met. In 2014, the PCE program provided $39.6 million in disbursements to utilities that served over 82,000 customers in 190 communities. Particularly in the context of Alaska's current budget challenges, there may be reason to assess how efficiently programs such as PCE are achieving their stated purposes. This report provides evidence that contributes to such an assessment by examining three specific issues:

- How alternative organizational structures affect the costs of electric services
- Potential impacts of cross-subsidies through "postage stamp" rate designs
- Quality of the evidence available on efficiency of subsidy programs

II. Impact of alternative utility organizational structures on costs

The PCE provides funds to certain high-cost utilities. Theses utilities have significant differences in organizational structure. Some are cooperatives, some are municipal or village agencies, and some are investor-owned utilities (IOUs.) These utilities vary widely in size. In two cases, Alaska Power Company (APC) and Alaska Village Electric Cooperative (AVEC), a single entity runs multiple utilities that are not interconnected. In this report, we call companies or cooperatives that manage multiple local utilities that are not interconnected into a single grid "regional" utilities. The cost of electric service varies widely in rural Alaska among these different utilities, and this section attempts to determine if there are any differences in costs that seem to be correlated with differences in organizational structure.

II. A. Compare productivity between organizational structures

This section uses the most recently available cost data from PCE annual reports, audited financials, and rate cases to compare costs. This analysis focuses particularly on the sum of distribution costs, customer service costs, and general and administrative costs (DCG&A) per kWh. These are arguably the most directly comparable costs across different utilities. The two other significant components of costs are power production costs and capital costs. Power production costs and capital costs depend heavily on the available generation alternatives. For example, a utility with significant hydroelectric generation capacity could have much lower fuel costs. Subsidies for investments in generating facilities and related infrastructure (such as fuel storage subsidies) can significantly affect capital costs.

Figure 1 plots the expenses for distribution, customer service, and general and administrative (DCG&A) for the utilities that qualified for PCE payments in 2012-16 against utility size, as measured by kWh generation. It is clear that DCG&A expenses vary significantly across utilities. These data indicate that:

- The DCG&A expense for communities with more than 6 million kWh per year have median and mean values in the range of $.06-$.07/kWh. DCG&A costs range from a low of $.02/kWh to a high of $.135/kWh.

- The DCG&A expense for communities with less than 6 million kWh per year are widely dispersed between $.06/kWh and $.40/kWh. The median value is $.088/kWh and the mean is $.125/kWh.

- The most efficient small utilities (less than 6 million kWh per year) can provide DCG&A at a cost in the range of $.06/kWh. This includes some communities that provide less than 1 million kWh per year.

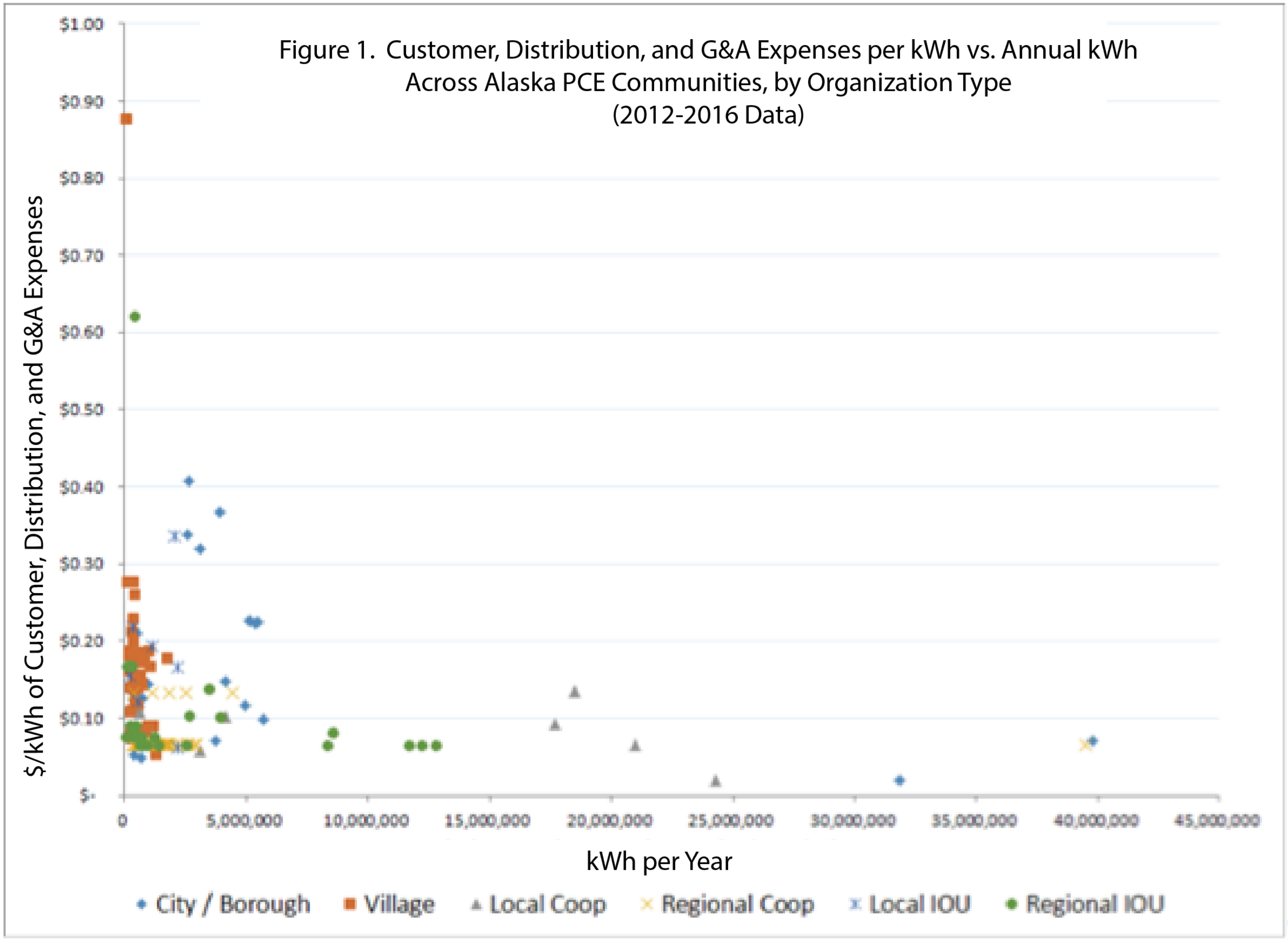


Figure 1. Customer, Distribution, and G&A Expenses per kWh vs. Annual kWh
Across Alaska PCE Communities, by Organization Type
(2012-2016 Data)
$/kWh of Customer, Distribution, and G&A Expenses
$1.00
$0.90
$0.80
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$-
0
5,000,000
10,000,000
15,000,000
20,000,000
25,000,000
30,000,000
35,000,000
40,000,000
45,000,000
kWh per Year
City / Borough
Village
Local Coop
Regional Coop
Local IOU
Regional IOU

Figure 2 focuses on those communities that generate less than 6 million kWh per year. When focusing on these communities, we can see the following distinction:

- Both regional coops and regional investor-owned utilities that serve small communities have DCG&A expenses in the range of $.06/kWh to $.08/kWh.

- City/borough utilities, village utilities, local coops, and local IOUs tend to have higher DCG&A expenses, with a mean of $.17/kWh and a median of $.14/kWh.

Figure 3 compares productivity between and within organizational structures, regardless of the level of generation. The number of communities served by each category is indicated by "n=". Figure 3 indicates:

- Regional coops have the lowest median DCG&A expense of $.065/kWh. Regional IOUs have DCG&A expenses of $.077/kWh. The utilities served by regional coops provide an average of 2.0 million kWh per year in each community. Regional IOUs provide an average of 2.5 million kWh per year in each community served.

- Local community coops tend to serve larger communities (12 million kWh per year average.) They have a higher median expense ($.083/kWh) compared to regional IOUs ($.077/kWh) but a lower kWh weighted average ($.074/kWh) than the regional IOUs ($.079/kWh.)

- The other organizational structures have markedly higher median costs to serve rural communities. Their costs range from $.11/kWh for city/boroughs to $.16/kWh to $.18/kWh for stand-alone villages and investor-owned utilities.

Larger regional coops and larger regional investor-owned utilities tend to be more efficient at serving small and larger rural communities, as compared to other organizational structures. The most efficient large regional coop, AVEC, includes a large regional hub (Bethel) and dozens of smaller villages. The consolidation of small regional coops, investor-owned utilities, and stand-alone coops into regional organizational structure would appear to offer significant opportunities to reduce the cost of distribution, customer service, and general and administrative functions.

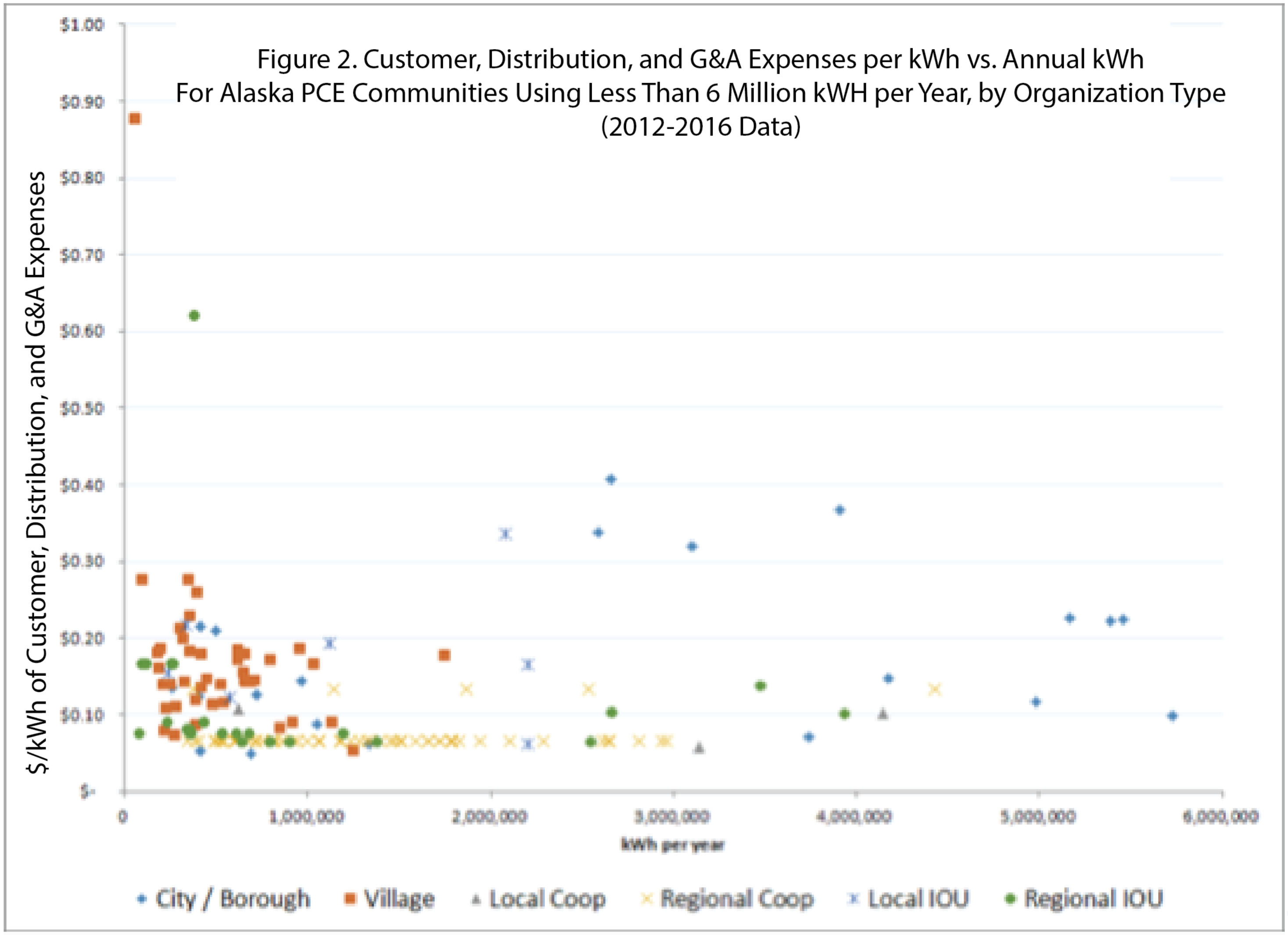


Figure 2. Customer, Distribution, and G&A Expenses per kWh vs. Annual kWh
For Alaska PCE Communities Using Less Than 6 Million kWH per Year, by Organization Type
(2012-2016 Data)
$/kWh of Customer, Distribution, and G&A Expenses
$1.00
$0.90
$0.80
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$-
0
1,000,000
2,000,000
3,000,000
4,000,000
5,000,000
6,000,000
kWh per year
City / Borough
Village
Local Coop
Regional Coop
Local IOU
Regional IOU

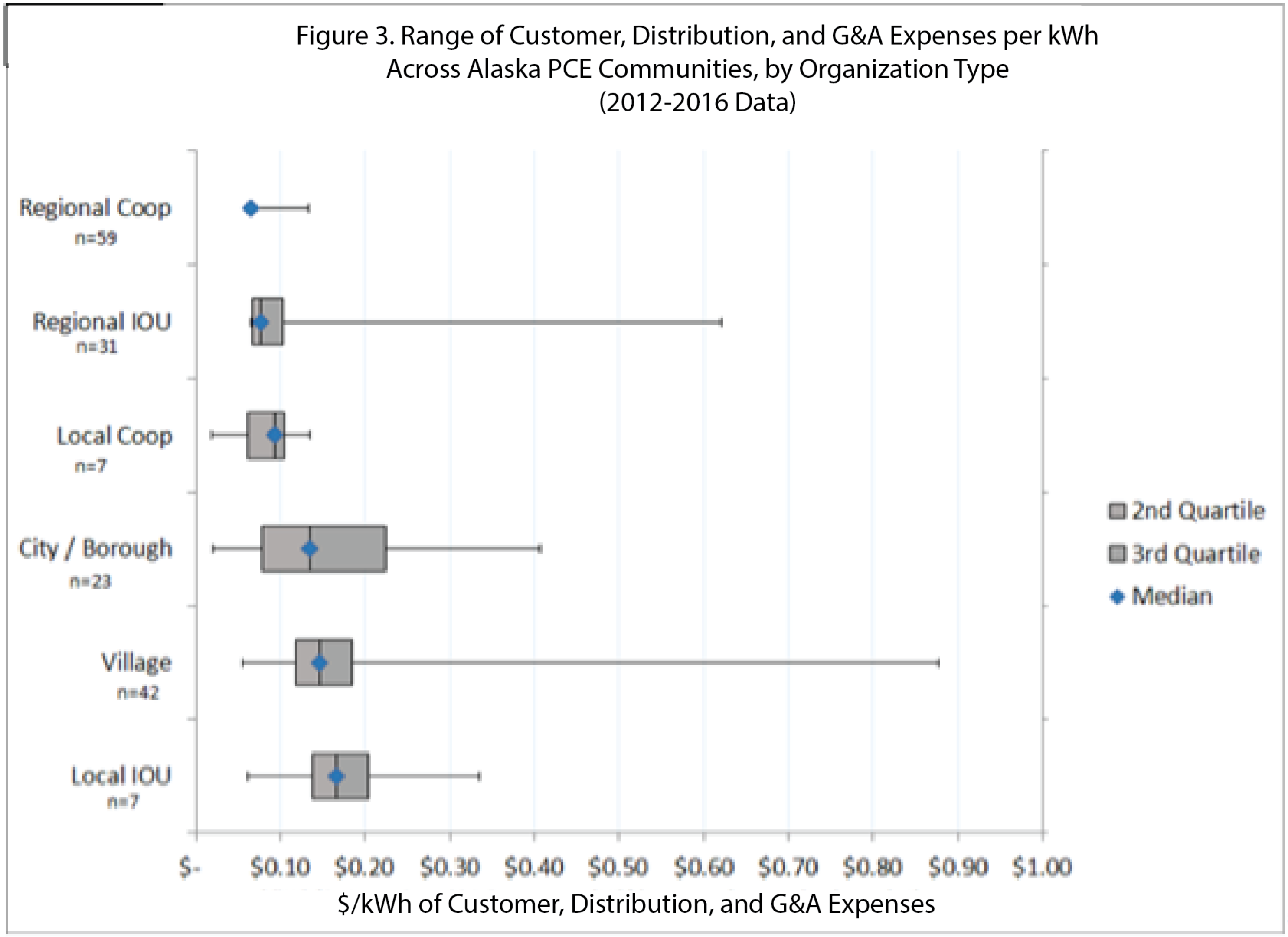


Figure 3. Range of Customer, Distribution, and G&A Expenses per kWh
Across Alaska PCE Communities, by Organization Type
(2012-2016 Data)
Regional Coop
n=59
Regional IOU
n=31
Local Coop
n=7
City / Borough
n=23
Village
n=42
Local IOU
n=7
2nd Quartile
3rd Quartile
Median
$-
$0.10
$0.20
$0.30
$0.40
$0.50
$0.60
$0.70
$0.80
$0.90
$1.00
$/kWh of Customer, Distribution, and G&A Expenses

Figure 4. Cumulative kWh vs. DCG&A/kWh by Organization Type

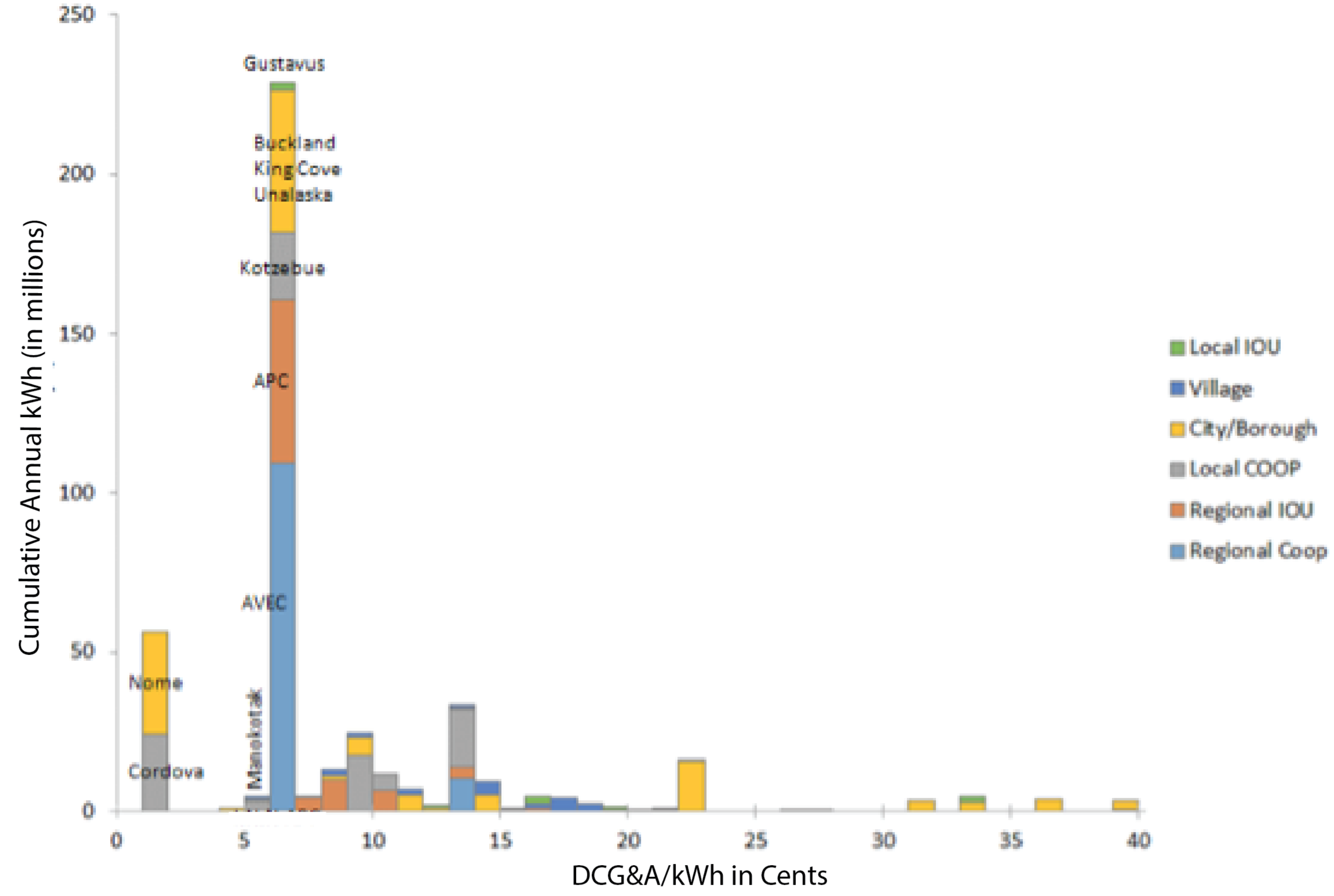


Figure 4 examines the relationship between productivity (measured as DCG&A costs per kWh) and organization type of utility. Note that the vertical scale for Figure 4 represents the size of the utility, and the horizontal axis are "bins" based on DCG&A cost per kWh.

The high productivity (low DCG&A cost per kWh) utilities are Cordova Electric Coop and Nome Joint Utilities, at $.02/kWh. Cordova and Nome are relatively large regional hubs with annual kWh sales on the order of ten times that of mid-size villages. The next cost cluster, with DCG&A costs in the $.05/kWh to $.06/kWh bins include:

- I.N.N. (Iliamna, Newhalen, Nondalton)– local coop
- Manokotak - village
- AVEC (Alaska Village Electric Cooperative)– regional coop
- APC (Alaska Power Company) – regional investor-owned utility (IOU)
- Kotzebue – local coop
- Buckland, King Cove, Unalaska - municipal
- Gustavus – local investor-owned utility (IOU)

I.N.N., which we've characterized as a local coop (due to the relative proximity of its small number of communities) with 3 million kWh reports DCG&A expenses of $.058/kWh. AVEC, which serves a large regional hub (Bethel) and dozens of small to mid-size villages, is relatively efficient with DCG&A costs in the $.06-$.07/kWh range.

Table 1 presents a spreadsheet that examines the impact of AVEC's acquisition of the Bethel utility in 2014. That acquisition led to an 18% reduction in DCG&A/kWh. AVEC's experience suggests that regionalization can yield significant economies of scale in DCG&A functions. After the acquisition of Bethel in 2014, AVEC DCG&A/kWh fell to the point that it is 6% below that of APC in FY2015. APC may see analogous productivity improvements following the integration of Gustavus into its family of communities served.

This analysis provides an important insight into the costs of electricity in rural Alaska. The common wisdom is that these differences are driven mostly by differences in the costs of fuel and in the scale of generation. This analysis shows that non-generation costs are, in fact, a major explanation for the cost differences. This analysis strongly suggests that total DCG&A expenses per kWh for rural Alaska could be significantly reduced through consolidation among the smallest utilities. The issue of high DCG&A costs for some utilities might also be addressed in the subsidy determination process by setting a per kWh cap on those expenses or differentially reimbursing DCG&A costs above some level. Figure 5 groups small utilities by their DCG&A costs per kWh, in one-cent increments, and uses the data from Figure 4 to estimate the possible cost savings that might be realized were all of the local stand-alone utilities (village, investor-owned, and municipal) with DCG&A costs above $.07/kWh able to achieve $.07/kWh by joining a large regional coop. The estimated annual cost savings approaches $15 million per year, which is large relative to the 2014 total PCE subsidies of about $40 million.

Table 1. Review of Drivers of AVEC and APC Cost Productivity
(from Annual PCE Cost-Support filings)

Description	FY 2012	FY 2013	FY 2014	FY 2015	Percent change, 2012 - 2015
Total Power Production Expense	$9,431,983	$9,575,802	$8,595,848	$11,234,966	
Distribution Expense (O&M)	$1,235,348	$1,251,252	$1,164,608	$1,343,691	
Customer Account Expense	$1,468,554	$1,610,242	$1,690,780	$2,693,370	
General and Administrative	$3,240,615	$2,899,721	$3,078,979	$3,349,366	
Allowable Fixed Costs	$4,458,137	$3,974,548	$4,387,123	$4,987,352	
Total Costs	$19,834,637	$19,311,565	$18,917,338	$23,608,745	
Distribution, Customer Account and G&A	$5,944,517	$5,761,215	$5,934,367	$7,386,427	
Total kWh Sales (unadjusted)	74,080,714	73,721,925	104,428,156	112,845,034	
Distribution, Customer Account and G&A per kWh	$0.0802	$0.0781	$0.0568	$0.0655	**-18.4%**

			Includes Bethel part year	***Includes Bethel full year***
Total Cost per kWh	$0.268	$0.262	$0.181	$0.209
Distribution, Customer Account and G&A	$0.080	$0.078	$0.057	$0.065
Power Production and Fixed Cost Expense per kWh	$0.187	$0.184	$0.124	$0.144

Compare to APC:	
APC DCG&A per kWh 2015 (U-14-002)	$0.0696
AVEC DCG&A per kWh 2016	$0.0655
Percent difference, AVEC compare to APC	-5.9%

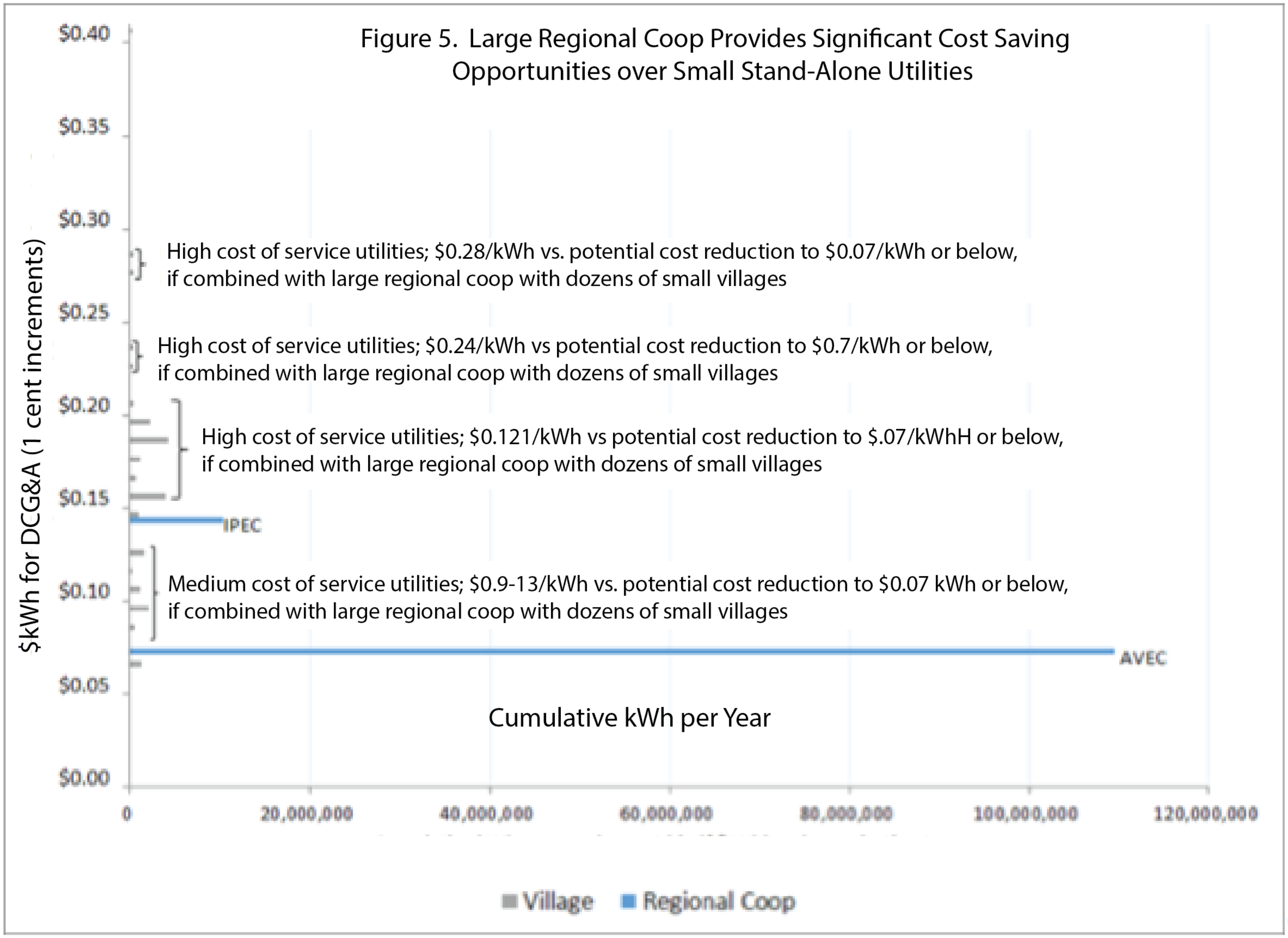


Figure 5. Large Regional Coop Provides Significant Cost Saving Opportunities over Small Stand-Alone Utilities
$kWh for DCG&A (1 cent increments)
$0.40
$0.35
$0.30
$0.25
$0.20
$0.15
$0.10
$0.05
$0.00
High cost of service utilities; $0.28/kWh vs. potential cost reduction to $0.07/kWh or below, if combined with large regional coop with dozens of small villages
High cost of service utilities; $0.24/kWh vs potential cost reduction to $0.7/kWh or below, if combined with large regional coop with dozens of small villages
High cost of service utilities; $0.121/kWh vs potential cost reduction to $.07/kWhH or below, if combined with large regional coop with dozens of small villages
IPEC
Medium cost of service utilities; $0.9-13/kWh vs. potential cost reduction to $0.07 kWh or below, if combined with large regional coop with dozens of small villages
AVEC
Cumulative kWh per Year
0
20,000,000
40,000,000
60,000,000
80,000,000
100,000,000
120,000,000
Village
Regional Coop

II. B. Attracting private capital to the Alaska electric utility sector

As discussed above, regional utilities—and especially large regional cooperatives that provide service to a range of rural communities—have lower DCG&A costs per kWh. This section analyses the extent to which these larger, regional utilities are also able to achieve a lower cost of capital.

The analysis of the cost of capital for rural Alaska utilities is complicated by the large state and federal grants of capital for infrastructure made to many of these communities. Moreover, state and federal programs also absorb some of the operational risks associated with small rural utilities through various types of financial rescue of troubled utilities.

But even with the possibility of outside financial rescue, utilities in small villages present significant risk and cash flow volatility. This translates into significant challenges to attracting private capital, so the equity returns required to attract private investment in small stand-alone utilities may exceed 20%. Small utilities are also much less able to access debt markets. A large regional coop can achieve much more stable financial performance and can be expected save as much as 12% (1200 basis points) on the cost of capital. This lower capital cost reflects an estimated 4.5% (450 basis point) reduction in the cost of equity and a much heavier reliance on lower cost debt financing. This presents a significant opportunity for smaller communities to improve their access to private capital by joining larger regional governance and management structures.

Rate-making for investor-owned utilities includes an allowance for the cost of capital, including both interest costs and a return on equity. Electric utilities outside rural Alaska typically have made large, long-term investments in generation, transmission, and distribution. They are therefore very capital-intensive, and the cost of capital can approach or exceed 50% of rates. Because of the state and federal capital grants to utilities in rural Alaska, the cost of capital is a smaller share of total costs. Probably because of the importance of externally-provided capital in rural Alaska, the state statute that defines PCE subsidy calculations [AS 42.45.110(a)] does not allow a return on equity. To the extent that PCE subsidies determine the financial condition of rural utilities, not including a return on equity discourages private investment and generally affects decisions about financing. Allowing a return on equity in the PCE program would encourage utilities to improve debt service coverage ratios and to build equity that can lower borrowing costs. Such changes would improve the risk/reward profile for utility service to small and mid-sized rural communities and thereby improve their attractiveness to private capital.

Cost of Capital Estimates

We develop estimates of the cost of capital for rural Alaska utilities using the methodology of Duff and Phelps (*2016 Valuation Handbook-Guide to Cost of Capital.)* We compare the cost of equity for small, local utilities to regional utilities across organizational types. The merger of small stand-alone village utilities with a large regional coop yields an estimated 450-basis point (4.5 percent) reduction in the estimated cost of equity (see Figure 6). On a $1 million investment, a community served by a regional coop would save $830,000 over 20 years on return on equity, as compared with a community served by a small stand-alone utility.

Figure 6 shows the data used to estimate this 450-basis point difference in the cost of equity. We created pro forma financials for seven representative types of utilities. The pro forma sets of financials for the most and least expensive utilities, a village scale utility, and a large regional cooperative utility, respectively, are shown in Table 2. The calculations show a 450-basis point difference in the cost of equity between the smallest and largest utility. The dotted line in Figure 6 estimates the relationship between the cost of equity and utility size across the spectrum of rural utilities.

Figure 6. Cost of Equity Estimate vs. Annual Sales for Rural Alaska Scale Electric Utilities

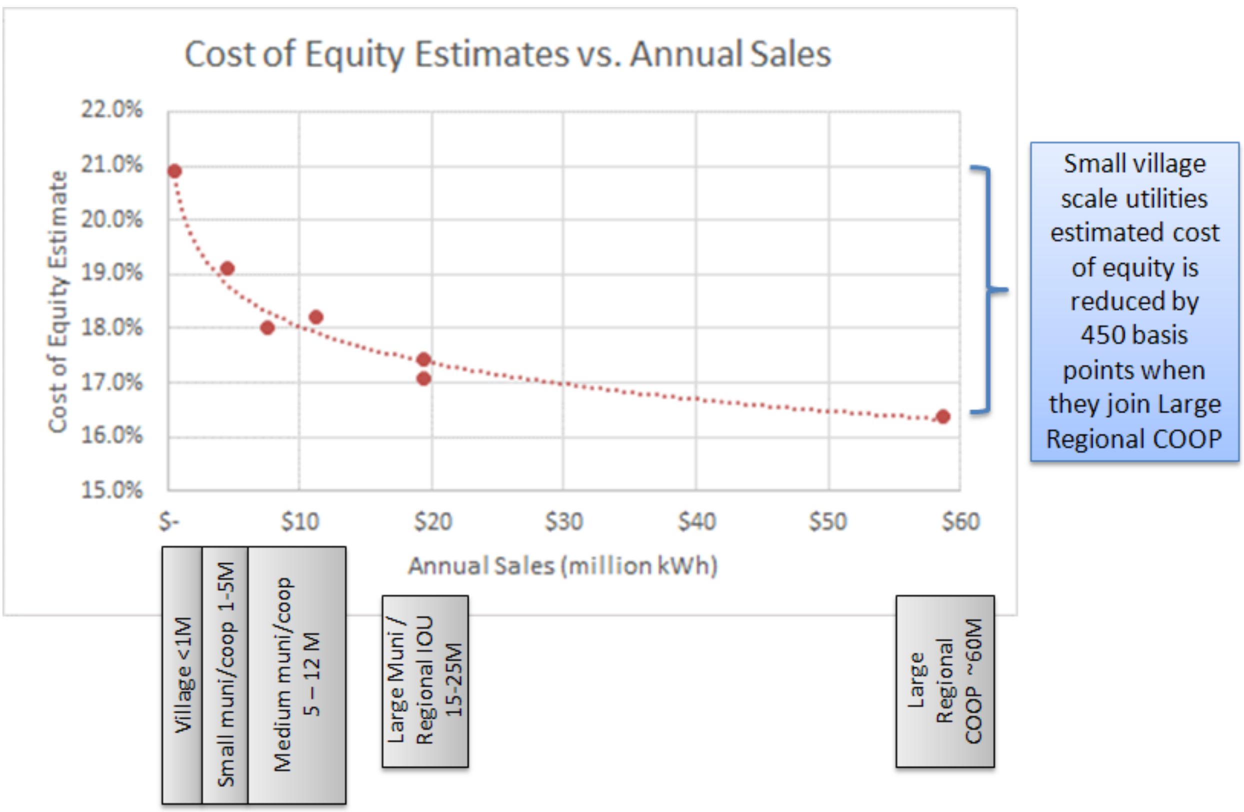


Table 2. Illustrative Examples of Duff & Phelps 2016 Valuation Handbook Cost of Equity Estimates using Build-Up Method 1 extended to rural Alaska scale electric utilities

Village Scale Rural Utility			Build-Up Method 1 Cost of Equity Capital Estimate			
	Size Range ($millions, except employees)	Duff & Phelps Valuation Handbook Exhibit (2016)	Risk Free Rate	Smoothed Premia over risk free rate	Equity Risk Premium Adjustment	Cost of Equity Capital Estimate
Size Measure	Village Scale Rural Utility		R_f	RP_{m+s}	ERP	k_e
Book Value of Equity	1.641	A-2	4.0%	15.2%	0.1%	19.3%
Total Assets	1.229	A-5	4.0%	17.7%	0.1%	21.8%
5-Year Average EBITDA	0.101	A-6	4.0%	17.1%	0.1%	21.2%
Annual Sales	0.486	A-7	4.0%	17.5%	0.1%	21.6%
Number of Employees	2	A-8	4.0%	16.6%	0.1%	20.7%
Mean Values						20.9%

Large Regional COOP Utility			Build-Up Method 1 Cost of Equity Capital Estimate			
	Size Range ($millions, except employees)	Duff & Phelps Valuation Handbook Exhibit (2016)	Risk Free Rate	Smoothed Premia over risk free rate	Equity Risk Premium Adjustment	Cost of Equity Capital Estimate
Size Measure	Large Regional COOP Utility		R_f	RP_{m+s}	ERP	k_e
Book Value of Equity	49.786	A-2	4.0%	11.8%	0.1%	15.9%
Total Assets	121.973	A-5	4.0%	12.4%	0.1%	16.5%
5-Year Average EBITDA	12.769	A-6	4.0%	12.2%	0.1%	16.3%
Annual Sales	58.642	A-7	4.0%	12.7%	0.1%	16.8%
Number of Employees		A-8	4.0%			
Mean Values						16.4%

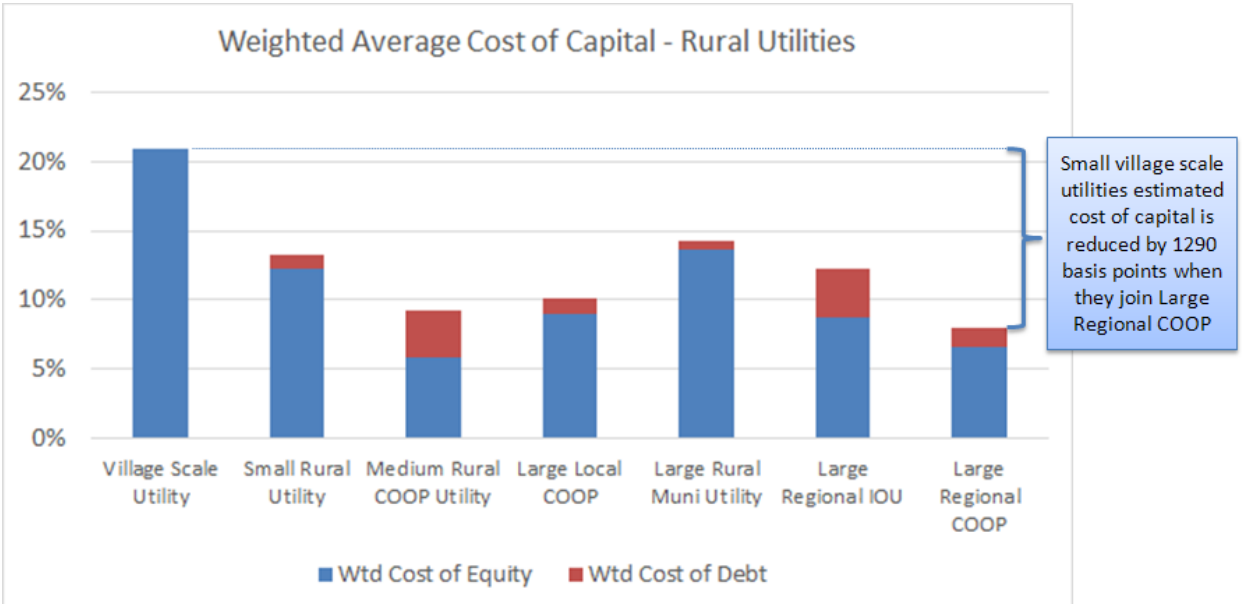
Utilities can finance their capital through equity (*i.e.,* owner investments) or debt (such as bonds.) In large utilities, there can be multiple types of equity (such as common and preferred stock) and multiple forms of debt (such as bank loans, government loans, and bonds.) For present purposes, it is sufficient to consider simply the two basic sources of capital, debt and equity.

The total cost of capital is the weighted sum of the cost of equity and the cost of debt:

Total cost of capital= (% equity) x (cost of equity) + (% debt) x (cost of debt)

Equity costs by size of utility were estimated above. The cost of debt and the debt and equity percentages were compiled from most recent Regulatory Commission filings (2015, 2016), including PCE annual reports, annual audited financials, simplified rate filings (for coops), and rate cases (for investor-owned utilities). The results of those calculations are presented in Figure 7.

Figure 7. Weighted Average Cost of Capital – Rural Alaska Electric Utilities



The combination of greater reliance on debt financing and the lower cost of equity for the larger regional coop provides significant cost of capital savings as compared with other organizational structures that serve small to mid-sized rural communities.

To understand Figure 7, let us look specifically at the village scale utilities and the large regional coop. Our sample of five small village-scale utilities was taken from the middle of the small village size distribution as measured by kWh per year in sales. None of the utilities had long-term debt. A number of small village utilities did carry outstanding balances on their fuel loans from the State of Alaska, but this short-term financing is not the same as long-term debt. Therefore, our sample of small utilities is 100% equity financed. This would not be unusual for many small businesses, which do not have access to bond financing and whose risk is too high for bank financing. To apply the cost of capital equation, assume a bank loan rate of 5%. With 100% equity financing, the cost of capital is:

Small utility cost of capital = 100% * 20.9% + 0 % * 5% = 20.9%

For the large regional coop, the estimated cost of debt financing is 4% and the company is financed as 66% debt and 33% equity. This yields a total weighted cost of capital of 8.09%.

Regional utility cost of capital = 67% * 4% + 33% * 16.4 = 8.09%

II. C. Best practices in utility management

This final sub-section about costs of different types of utility organization in rural Alaska addresses the issue of internal governance. By internal governance, we mean issues such as professional management and oversight by independent governance boards. These issues are both more difficult to measure than simply the cost of service or the cost of capital and also are intertwined with those two issues. A more professional technical management can make operational decisions that reduce costs and more professional financial management can make decisions that reduce the cost of financing.

The issue of the effect of energy subsidies on economic performance has generated significant interest, including a 2013 report by the World Bank (L. A. Andrés, J. L. Guasch, and J. Schwartz [editors]. 2013. *Uncovering the Drivers of Utility Performance.*) That report identified four "best practices" that promote efficient utility performance:

1. An independent, performance-driven board of directors
2. Professional staff
3. Transparent measures of price, performance, and management
4. Clear mechanisms for evaluating performance

The World Bank analysis does suggest some steps that Alaska might take to promote best practices. For example, Alaska could require periodic Regulatory Commission of Alaska (RCA) review of whether utilities have achieved a minimum level of compliance with best practice as a threshold for the PCE subsidy eligibility. Statutory authority and rulemaking would be required to establish the minimum criteria for best practice. Such criteria would probably go beyond simply the World Bank *Drivers of Utility Performance*. For example, a minimum working capital requirement, such as 45 days of cash balances, might be appropriate to avoid utilities that are constantly on the financial brink. An alternative to a strictly regulatory approach might be to provide incentive payments from the PCE Endowment for PCE communities that have adopted "exceptional" levels across all best practices. Again, this would likely require statutory authority and rulemaking to establish and define "exceptional" levels of best management practice.

III. Postage stamp rate design issues for PCE communities

Overview

The PCE program makes energy more affordable in high-cost areas. Depending on how the energy subsidies are funded, they can have impacts on the total cost of energy services. When electric service is subsidized by PCE, the lower cost of electricity encourages consumers to use more electricity. To a great extent, this is an intentional effect. As long as the subsidy for the lower rates comes from some type of government program, such as the PCE Endowment, this is the only effect on customer decisions. But if the source of funds for the subsidy were in part from other customers, then the implicit cross-subsidy also creates incentives for those with higher rates to reduce purchases of utility electricity.

Even with the PCE program, there remain wide differences in the costs of electricity across rural Alaska. One proposal to reduce these differences is to create a single rate for electricity for some set of customers. These uniform rates are often called "postage stamp rates", which borrows the post office analogy that first-class rates are uniform regardless of where you live. Postage stamp rates might be applied at two different levels. First, all customers of a certain class for a utility might be charged the same rate. Thus, for regional utilities such as AVEC and APC, there might be a postage stamp rate for all residential customers. Or, at a higher level, there might be a single residential rate for all of rural Alaska. Another way to think of postage stamp rates is that costs are shared (or averaged) over some set of customers.

Incentives under postage stamp rates

Postage stamp rates are implicitly a subsidy to higher-cost customers from lower-cost customers. The central issue is how this subsidy is financed. There are three broad alternatives to finance postage stamp rates:

1. By a redistribution of existing PCE subsidies

2. By raising rates for the same class of customers (usually, residential customers) in one utility or service area in order to lower rates for customers in the same class at another utility or service area. When this cross-subsidization occurs within a single utility, such as among different villages in a regional utility, this cross-subsidization will occur as internal financial flows. When the cross-subsidization occurs across different utilities, some kind of payment from the low-cost utility to the high-cost utility is required. This is typically accomplished by some kind of government-run pool that manages the collections and payments.

3. By raising rates of one class of customers (*e.g.,* commercial) to lower the rates for another class of customers (*e.g.,* residential.) As with approach (2), this cross-subsidization may be within a single utility or across utilities by some kind of pooling.

Some combination of the three sources of financing could also be used. All approaches create incentives that should be understood.

Any of the three approaches can result in weaker incentives for each utility to control costs. If high cost utilities get either higher PCE subsidies or payments from some kind of pooling of revenues, then the utility has weaker incentives to reduce costs. Given the evidence above that DCG&A costs vary widely even among similar-size utilities, there should be some concern that postage stamp rates will serve to support low productivity utilities at the expense of high productivity utilities.

The cross-subsidization in approaches (2) and (3) results in some customers paying higher rates (relative to the unsubsidized case) and some customers paying lower rates. Those customers paying higher rates therefore have greater incentives to conserve on the use of electricity and those customers paying lower rates have incentives to use relatively more electricity. From a utility regulation perspective, the question is how strong are the incentives to alter the use of electricity. Much of that depends on the alternatives available to customers. For example, if residential customers have access to natural gas, then higher electric rates will encourage them to switch to natural gas for cooking, heating water, and drying clothes. Conversely, low electric rates can encourage the residential use of electricity for space heating. Commercial customers, in general, have more choices when faced with higher electric utility costs. The question of what happens to the overall level of use of electricity is important because electric utilities often have large fixed costs for generation and distribution that do not vary (or do not vary much) when the amount of electricity used changes. Decreases in electricity use due to higher rates may result in higher costs per kWh for the utility.

This reduction in use of utility-generated electricity can be especially problematic if some commercial customers can generate their own electricity at lower cost. In this case, they may choose to leave the electric grid to self-generate, which is called "by-pass." This by-pass will typically result in higher total costs for the system.

To understand this effect, consider a simple example. Assume:

- Community A has electric costs of $.30/kWh and generates 10,000 megawatt-hours of power per year, for a total cost of $3 million.
- Community B has electric costs of $.10/kWh and also generates 10,000 megawatt-hours of power per year for a total cost of $1 million.
- Community B has a single large customer that uses 5,000 megawatt-hours of power per year from the utility, but could self-generate at $.15/kWh.
- For simplicity, assume that the costs per kWh do not vary with output for either utility.

The total cost for these two communities is $4 million. If a postage stamp rate of $.20/kWh were imposed, then the large customer would choose to self-generate at a cost of $750,000. That would leave $3.5 million in costs for the utilities, $3 million in community A and $500,000 in community B. The postage stamp rate would have to increase to $.233/kWh. The total cost of generating the 20 megawatt hours has increased to $4.25 million, due to the incentive for inefficient by-pass.

By-pass is not a theoretical concept in rural Alaska. The costs for self-generation for large commercial entities and even some government facilities can easily be lower than the utility costs. This is because (a) the self-generator is often using similar generating equipment, particularly in communities that generate using diesel, and (b) the self-generator does not have to maintain distribution lines and some overhead services (such as billing.)

The specific design of a postage stamp rate will determine the degree to which by-pass in incentivized. If the PCE program only provides subsidies to residential customers and only increases rates for other residential customers, then incentives for commercial by-pass are minimal. Each utility will have an incentive to set commercial rates to avoid by-pass. To avoid by-pass, the utilities must be willing and able to lower its rates to its long run marginal cost of providing service to the commercial user.

Alaska Power Company as illustrative postage stamp rate design example

To understand how a postage stamp rate might work in some region, one could consider the case of the APC communities.

A postage stamp rate at the APC average rate of $.12/kWh favors high-cost frontier areas, such as Naukati, Whale Pass, Allakaket, Bettles, Eagle, Northway, Slana, Chistochina, and Mentasta, which pay $.22/kWh to $.27/kWh. This will implicitly require subsidies from the rest of the APC communities (Craig, Hydaburg, Hollis, Kasaan and Thorne Bay), and raises their rates by 33%, from the current $.09/kWh to $.12/kWh. That would increase the risk that large local customers, such as fish processing plants, will choose to self-generate. This could, in turn, raise the postage stamp rate above $.12/kWh.

Figure 8 looks in greater detail at the costs for groups of APC communities. The communities are divided by their source of generation, which is a major determinant of differences in costs. For each group of communities, the total costs are broken down into DCG&A cost and power production expense. That breakdown highlights that the booked cost of local power production differs by a factor of almost three, while the DCG&A costs vary only from $.07/kWh to $.09/kWh. The difference in power production costs is related to:

- Differences in access to local resources other than diesel. Notably, APC generation has migrated from 20% hydro to 70%-80% hydro over 15 years.
- The proportion of the other-than-diesel resource that has been financed by contributed capital from federal and state grants and low interest loans.
- Scale economies of power production systems. Many APC communities are served by larger scale diesel generation systems and central hydro resources that provide power to a local island grid (*e.g.,* Prince of Wales Island.) For those APC communities that are smaller and more widely dispersed and that depend on local diesel power production, the power production cost profiles are at or well above the aggregate average of AVEC.
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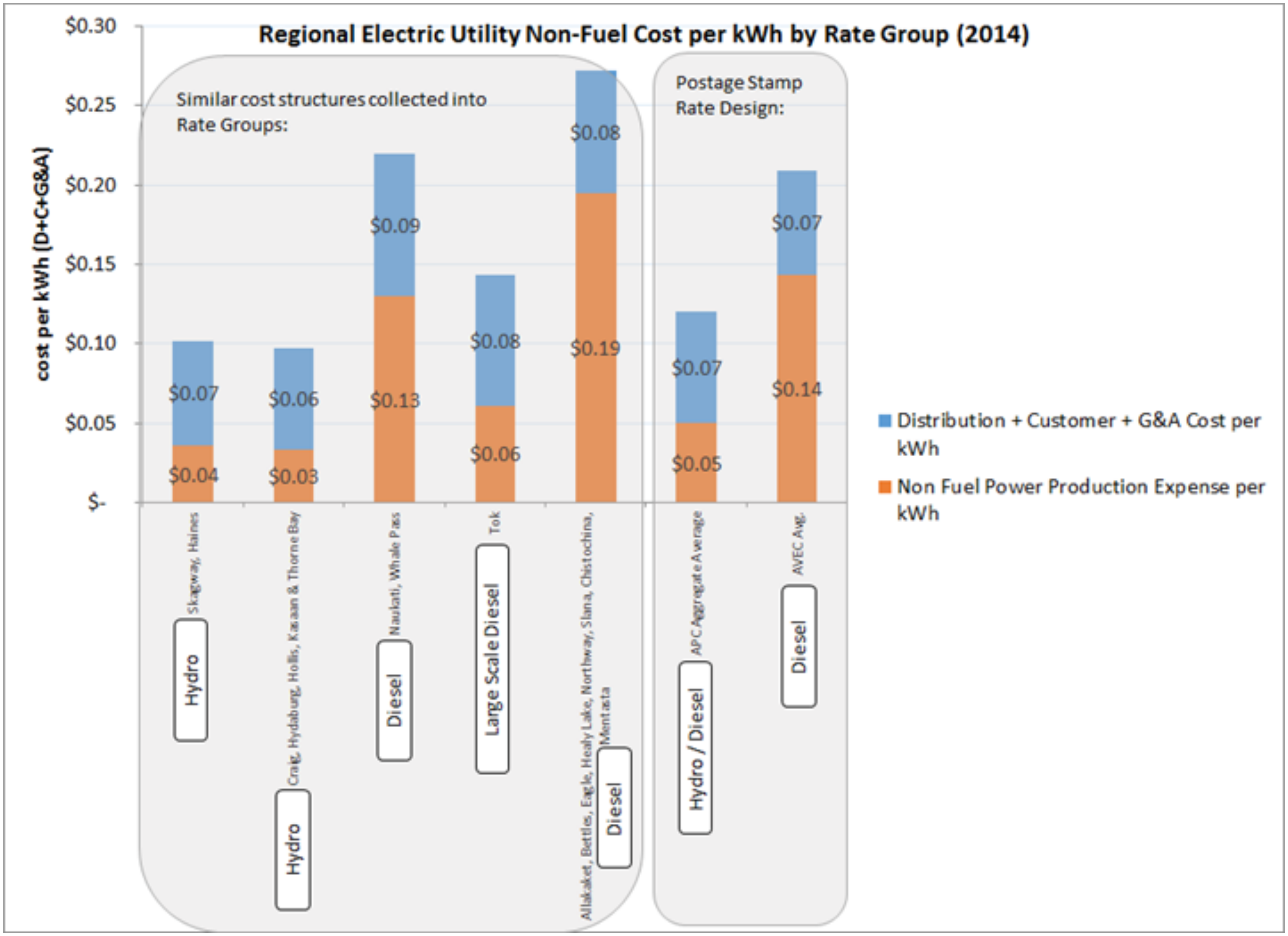
Figure 8: Regional Rate Group vs. Postage Stamp Rates



IV. Energy Subsidy Administration

Using direct energy subsidies to target certain disadvantaged populations is relatively limited in the U.S. An obvious exception would be the Low-Income Home Energy Assistance Program (LIHEAP.) Direct energy subsidies are more common internationally. On the other hand, utility rate-making in the U.S. has long involved various kinds of cross-subsidies in rate design, including lifeline electricity rates and "increasing block rates" that charge low rates for the first several hundred kWh used per month. The PCE subsidy is decided by the Regulatory Commission of Alaska and then financed from the PCE Endowment. It is the interaction between the subsidy elements and the utility regulatory elements that makes postage stamp rates relevant to PCE policy.

Direct energy subsidies on the international level have been broadly criticized. Two recent examples are reports by the International Monetary Fund (D. Coady, I. W.H. Parry, L. Sears, and B. Shang. 2015. "How Large Are Global Subsidies?" International Monetary Fund Working Paper 15/105) and by the International Energy Agency (International Energy Agency. 2015. Energy and Climate Change. A World Energy *Outlook* Special Report.) Those two reviews find that energy subsidies are large (more than 6% of global GDP) and that they are usually poorly targeted. Less than 10% of the benefits accrue to poor households that face challenges in paying for energy. These reviews conclude that the money could be better spent on roads, hospitals, and schools, if the goal is really to improve the welfare of the lowest income groups. Another recent study concluded that 36% of CO_2 emissions where associated with energy subsidies (R. Stefanski. 2014. "Dirty Little Secrets: Inferring Fossil-Fuel Subsidies from Patterns in Emissions Subsidies." Oxford Centre for the Analysis of Resource Rich Economies Research Paper 134.) Development aid agencies, such as the World Bank and the International Monetary Fund, frequently attempt to make energy-subsidy reform a component of financial recovery packages, but these reforms are notoriously difficult for governments to enact.

Underlying the criticisms of energy-subsidy systems are two arguments: First, the producers of energy vary widely in their efficiency. Subsidies allow inefficient producers to avoid consumer criticism, because subsidies hide the inefficiency. Earlier sections of this report suggest that utilities in rural Alaska do vary widely in their efficiency in the delivery of distribution, customer service, and general and administrative functions. Second, consumers of energy have many options in the use of energy, and subsidies create inefficient incentives for those consumers. Subsidies encourage consumers to use higher cost (but subsidized) sources; subsidies reduce the pay-off to energy-saving investments such as insulation or more efficient home heating systems; and subsidies encourage greater use of energy.

The administration of an energy subsidy program faces two related policy issues. First, what is the nature of the trade-offs between achieving the goals of lowering energy costs for some target population and the incentives that are created for inefficiency in production and consumption of energy? This is an inevitable trade-off in any energy subsidy program. But the second question is whether it is possible to re-design the energy subsidy program to achieve the goals of lowering energy costs for the target population with lower fiscal costs, with greater efficiency in the production and use of energy, and perhaps also with lower environmental impact.

Information to assess efficiency of PCE

This section examines the steps Alaska could take to better assess the efficiency of the both the PCE program and also the combined efficiency of energy subsidy programs, including the PCE, that affect rural Alaska. Transparency in the information about the PCE program and other energy subsidy programs is the main issue. We suggest five standards of transparency in these programs.

1. Information on energy subsidies and on the costs of utilities receiving energy subsidies should be transparent.

   The AEA annual report on PCE support, with data by utility on cost and price support, provides the data on which any assessment of the PCE must rely. A companion ISER report on the cost of electricity in rural Alaska demonstrated that, in a number of cases, the information filed with RCA (for subsidy determination) is not consistent with information in the AEA annual reports. Part (but not all) of the issue is differences in accounting for grants and low-interest loans for infrastructure. There are also issues about how well either the RCA or AEA data is suited to questions like the efficiency of fuel-saving investments. Sources of power other than diesel typically involve larger capital costs, and assessing the efficiency of such investments requires a present-value comparison of the higher investment costs and future reductions in generation costs. While the annual costs of power production are reported, the costs of capital for power generation are generally not separated from other capital expenditures. Separating capital costs into generating and non-generating assets would be very useful.

2. Information on energy subsidies should be integrated across programs.

   The PCE program is not the only energy subsidy program for rural Alaska. The LIHEAP program also subsidizes energy costs, and various state and federal programs subsidize capital costs. There are two different issues about how these programs interact. On the consumer side, there is the question of how well the various energy subsidy programs interact to cover vulnerable populations without providing duplicative subsidies. On the producer side, there is the question of how the various state and federal grants and low-interest loans interact with the PCE subsidy-determination process and with the rate-making process for investor-owned utilities. LIHEAP, the Alaska Housing Finance Corporation, and USDA Rural Utility Services should consider working with AEA to produce an Alaska Energy Subsidy Programs comprehensive report that collates data on the various subsidies by program, by community, by utility, and by impact on household affordability.

3. Information on quality of service by utilities receiving PCE should be transparent.

   An important element of electric service provision is reliability. Reliability is not only a convenience issue, but also a safety issue (*e.g.,* for customers using home health equipment.) The AEA annual report on PCE could consider adding customer outage data. For non-reporting utilities, AEA could consider sampling to establish proxy values on quality.

4. Energy subsidies should be assessed to determine how well they are targeted to those households and communities that have energy affordability challenges.

   Measuring the targeting of energy subsidies has inherent challenges in light of the well-known challenges in measuring median household income for small remote rural communities in Alaska. Rather than trying to measure income each year, it may make sense to use the American

Community Survey 5-year Median Household Income or the proportion of households that are eligible for the federal free and reduced lunch program. The AEA annual report on PCE could measure subsidy efficiency by the percent of PCE support attributable to the cost of reducing electricity payments to some target fraction of median household income (such as 2 percent) for each community served.

While it is important to recognize the inherent challenges in such measurements, that should not be an excuse for avoiding the issue of how well energy subsidies are targeted. The international evidence indicates that energy subsidies often fail to achieve equity goals. We should want to know if the current PCE subsidy-determination process favors relatively poorer or relatively richer communities.

5. Energy subsidies should measure the extent to which they support/encourage energy technologies associated with high CO_2 (global health) and high PM2.5 emissions (local health.)

   The AEA Annual Report on PCE could include estimates of CO_2 and PM 2.5 emissions per kWh and in total. The effects of other subsidy programs (LIHEAP, AHFC, and DOA-RUS) on CO_2 and PM 2.5 emissions could also be reported.

V. Summary

The executive summary at the beginning of this report provides a detailed summary. Here we note three over-arching points that emerge from this analysis:

1. Differences in distribution, customer service, and general and administrative expenses explain a surprising large share of differences in the cost of electric service in rural Alaska. It is possible to achieve greater economies in those costs through better incentives and through consolidation in the industry. Consolidation would also have beneficial effects for the cost of capital.

2. Using postage stamp rates to reduce the variation in electric rates in rural Alaska has two risks. First, it dilutes the incentives for efficiency in production. Second, careful rate design is required to avoid causing users able to generate their own electricity to bypass the utilities.

3. Transparency in both the operation of individual utilities and in the operation of energy-subsidy programs is essential if we want to reduce the costs of providing electric service in rural Alaska.