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December 6, 2016

MEMORANDUM

TO: Power Committee

FROM: Massoud Jourabchi

SUBJECT: Analysis of Residential Bills (an update)

BACKGROUND:

Presenter: Massoud Jourabchi

Summary: At the June 2016 Power Committee meeting staff presented an analysis of recent trends in average residential electricity use and bills, particularly focusing on the differences between the residential bills for the region's investor owned utilities (IOUs) and publically owned utilities (Publics). Staffs' analysis found that over the past 10 year, the average annual residential customer paid about \$1000 dollars per year for electricity. Not unexpectedly, staffs' analysis also found that the average residential electric bills varies widely across the region. Staff investigated some of the factors contributing to difference in residential electric bill and found that access to natural gas and utilities conservation acquisition levels as being more relevant factors than differences in stock and composition of residential sector or differences in income or poverty level in the service area.

A whitepaper was prepared and made available for comments. Nine comments from organizations and individuals were received. Staff has incorporated the comments, and updated the analysis to include 2015 figures on sales, rates and bills. Staff has also incorporated new data on BPA conservation achievements 2010-2014. The whitepaper was updated and is available for presentation to the Council.

Comparison of Northwest Residential Electricity Use, “Rates” and Bills (An update)

December 2016

Massoud Jourabchi

Context

- Follow-up to March and June staff presentations on recent trends in the average cost of electricity for residential customers
- Public comments received
- Updated with 2015 data on bills and rates
- Update Energy Efficiency Acquisitions
- Added data on access to natural gas
- Higher resolution examination of the potential factors that contribute to differences in residential electric bills
 - Type of utility ownership (public vs. private)
 - Differences in service area characteristics
 - Density (i.e., urban vs. rural)
 - Access to natural gas
 - Heating system efficiency
 - Vintage (i.e., age) of homes
 - Housing type mix (i.e., share of single family, multifamily and manufactured homes)
 - Historical energy efficiency
 - Household Income and Level of Poverty

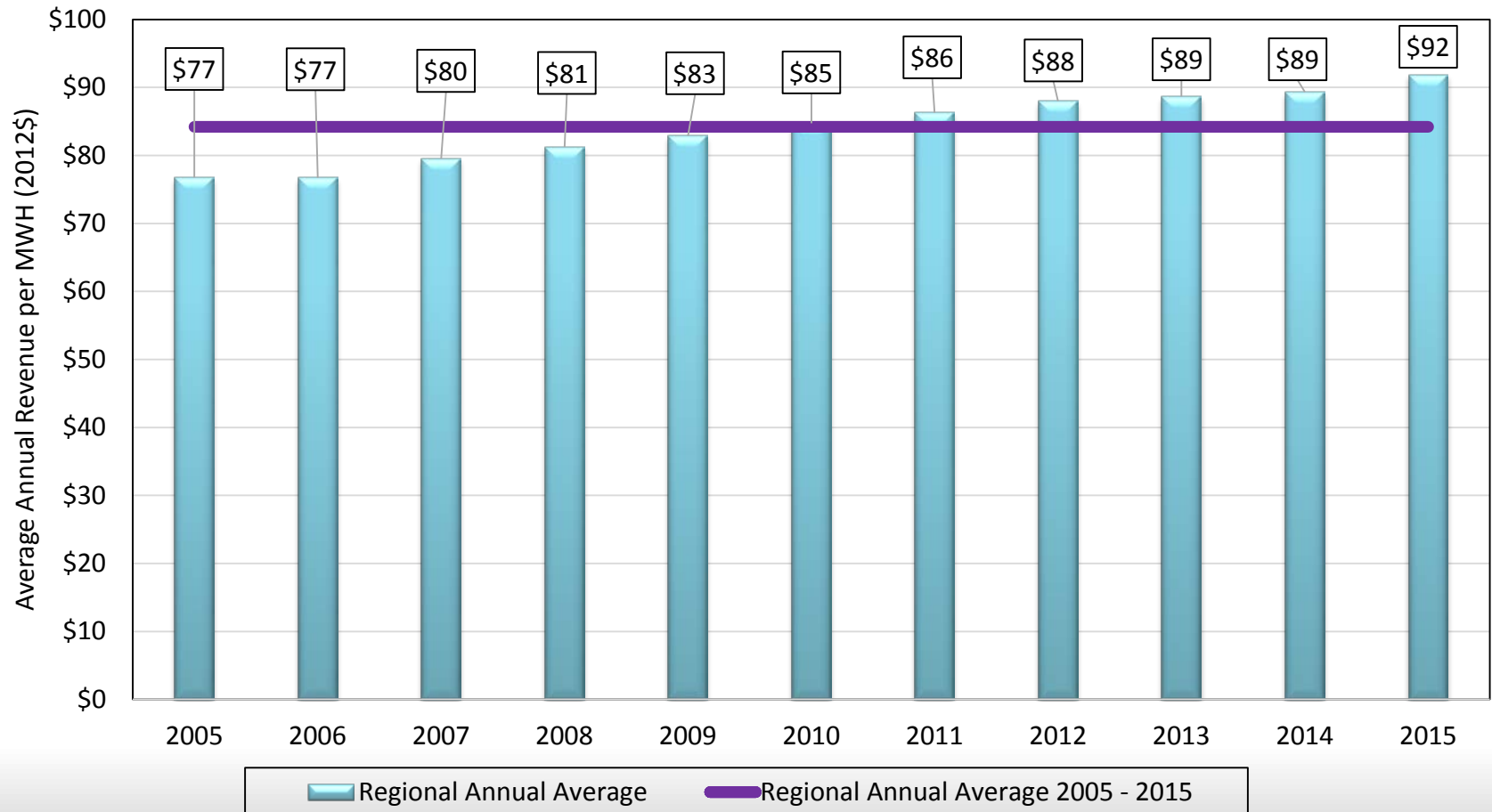
But Before We Start - Let's Define "Rates"

- As used in this presentation and in the issue paper “average rate” ***is not*** the average cost per megawatt-hour charged by utilities
- ***It is*** the total residential sector retail revenues/total residential sector retail sales. That is, it is the “average revenue” collected per megawatt-hour of retail sales.

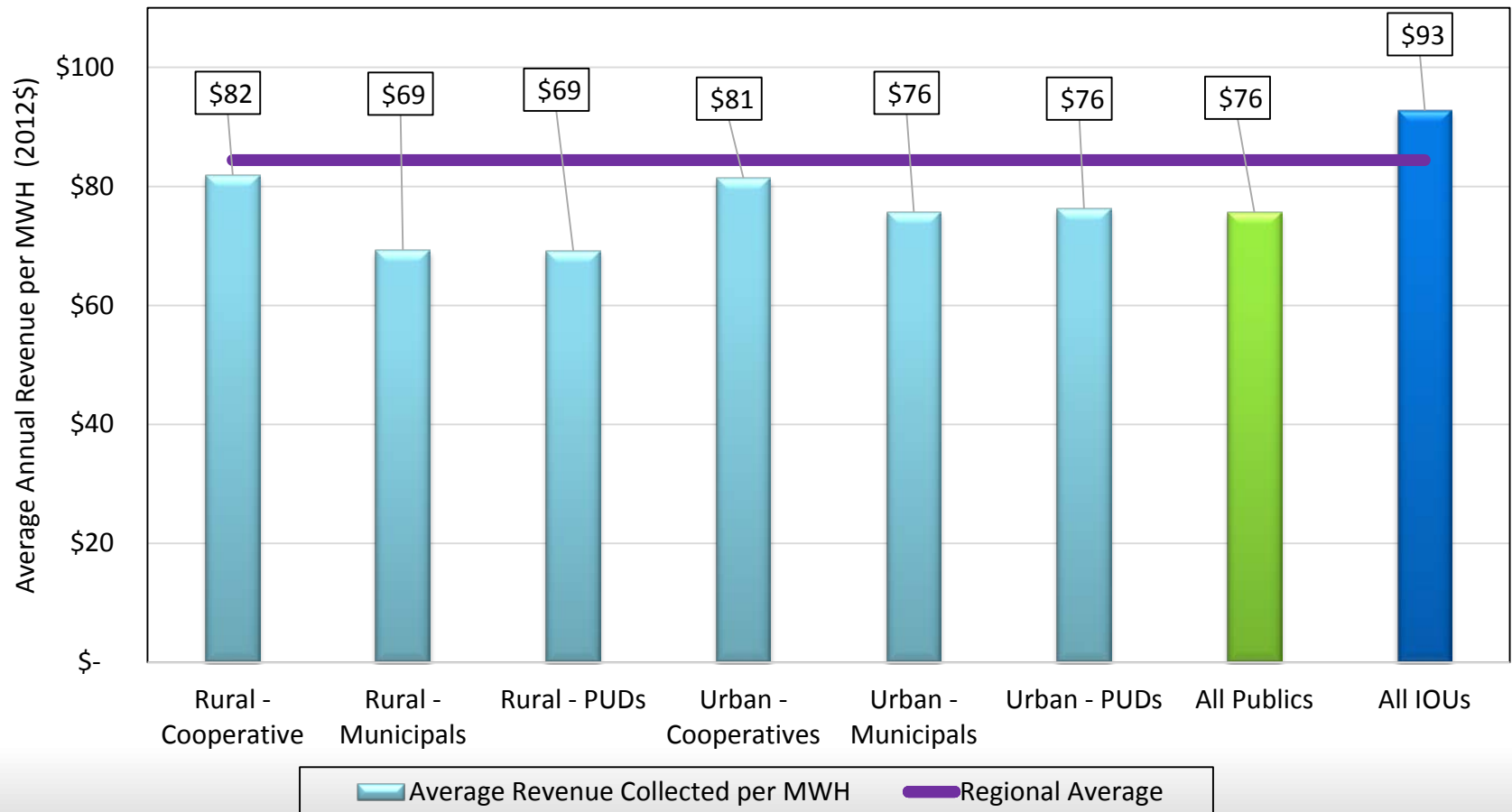
Comparing Electricity Bills

- Reflect both annual electricity use and cost per unit of electricity use
- Therefore, comparisons of “annual electric bills” requires an understanding of both
 - Annual electricity consumption
 - Average price per unit of consumption (i.e., average revenue per MWh)

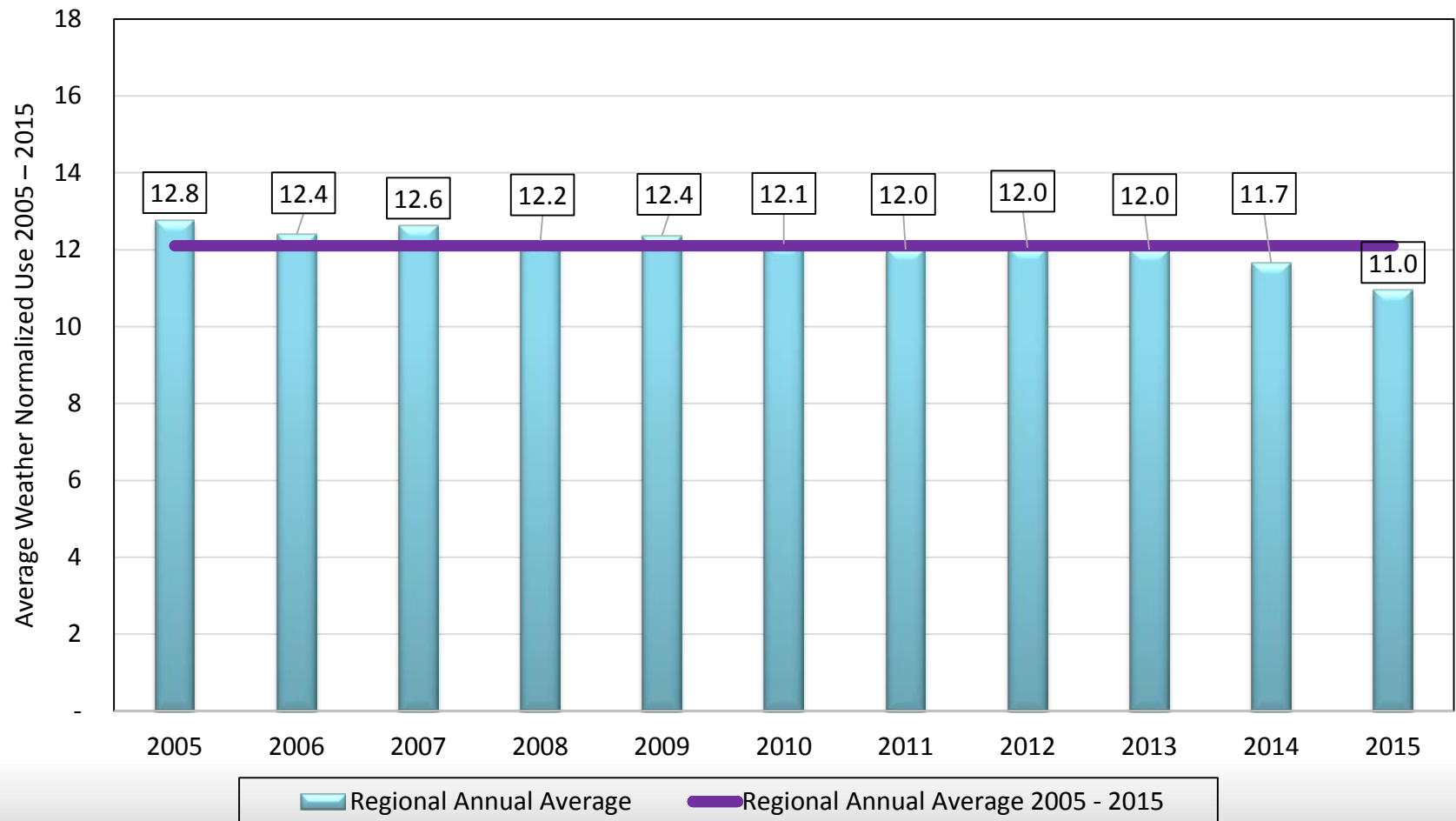
Key Finding: Over the past decade the average residential customer in the region paid about \$84/ MWH for electricity, although the average cost per MWh has increased by 20% over this period
(Values Adjusted for Inflation)



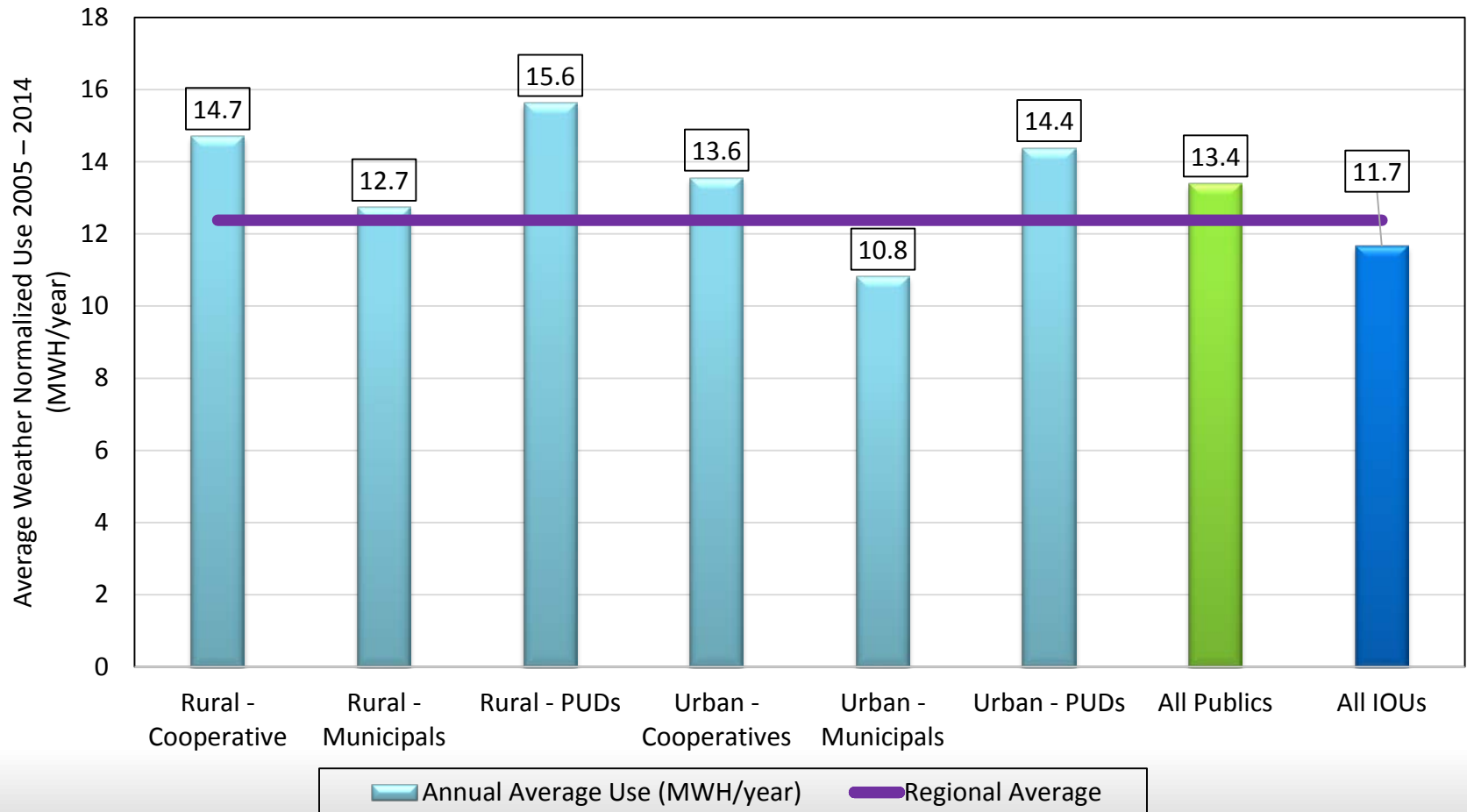
Key Finding: On average residential customers of publicly owned utilities paid about 18 percent less per MWH of electricity than residential customers of investor owned utilities



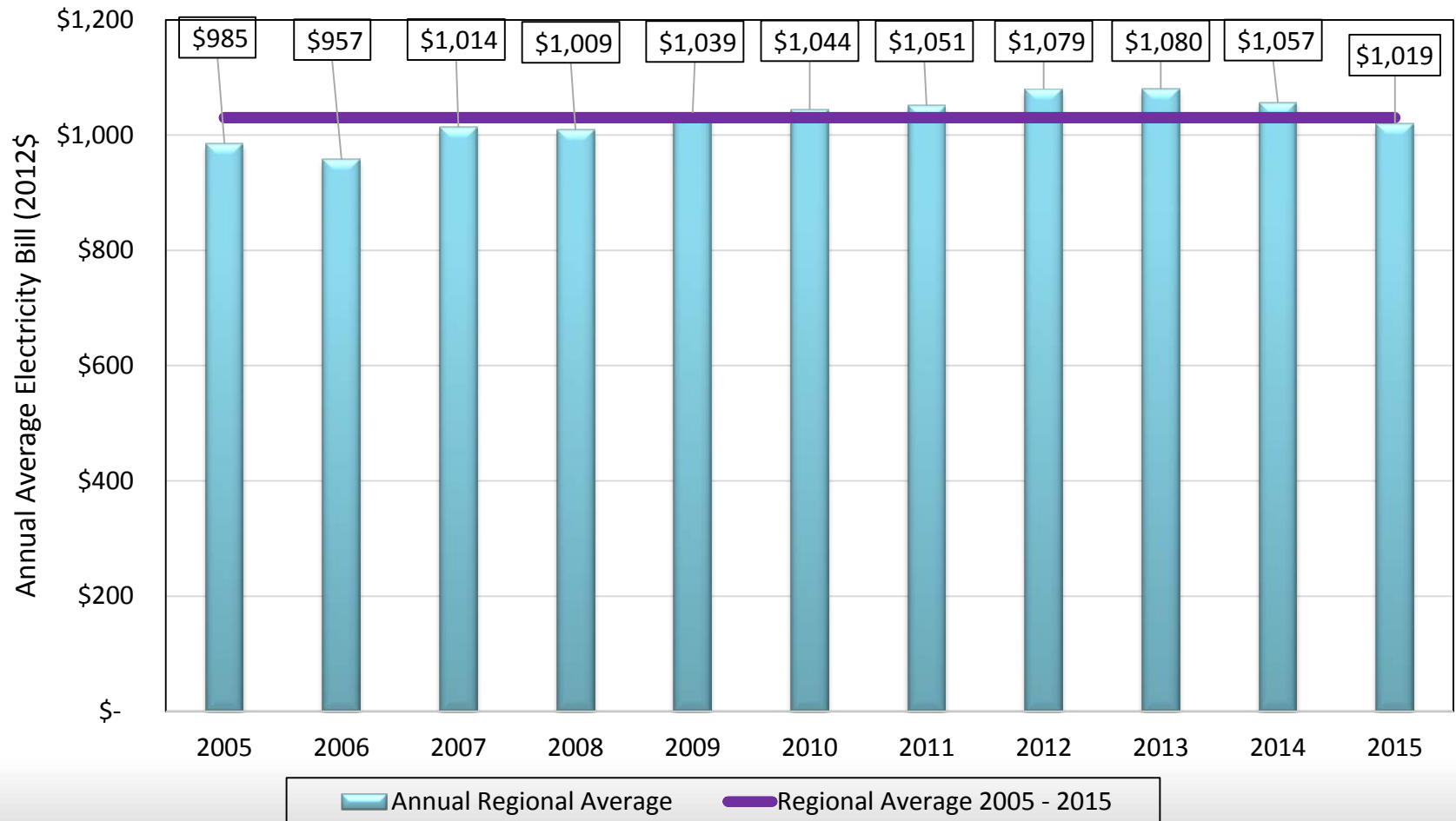
Key Finding: Over the past decade the average residential customer in the region consumed 12.1 MWH/year of electricity



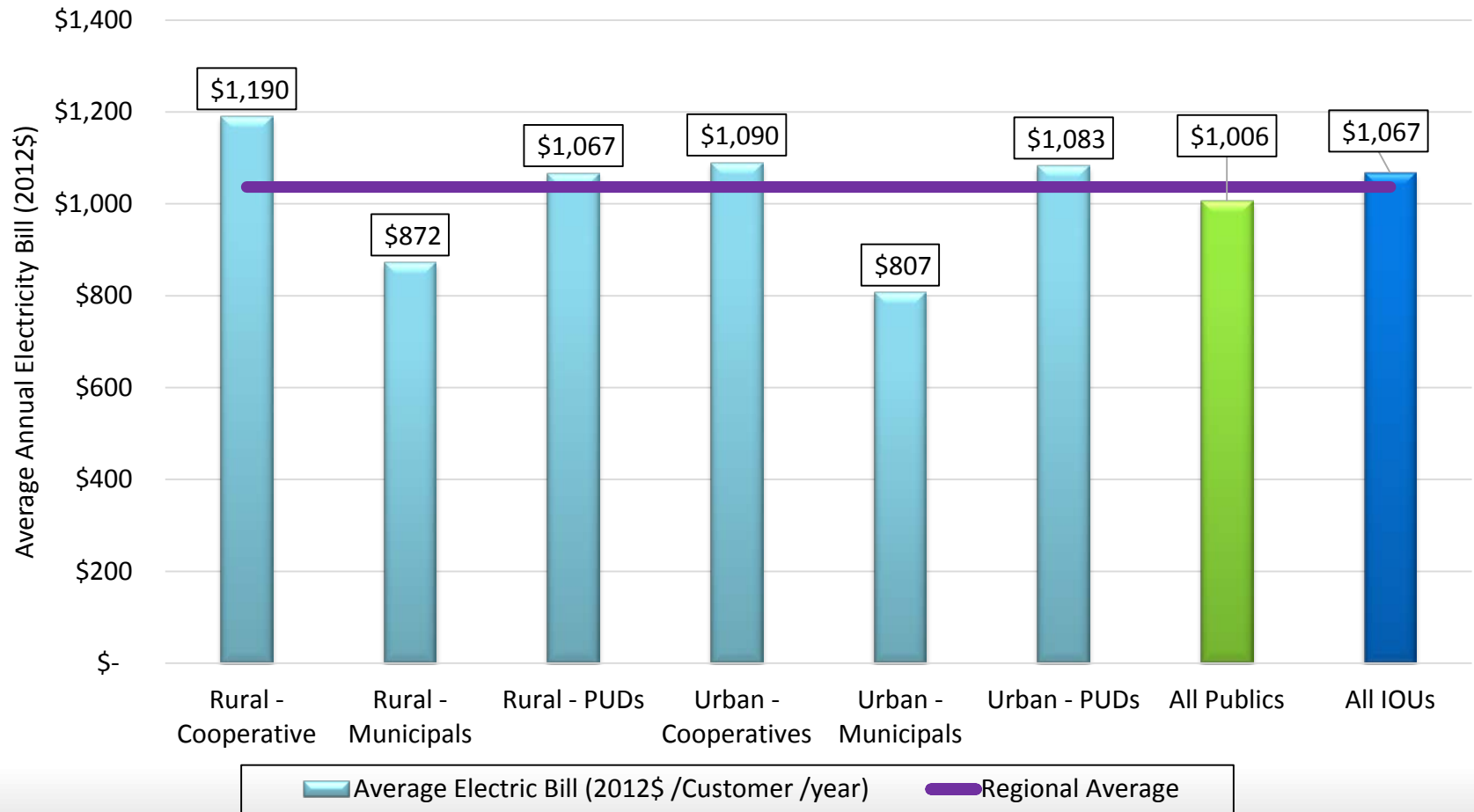
Key Finding: On average residential customers of publicly owned utilities consumed about 15 percent more electricity than residential customers of investor owned utilities



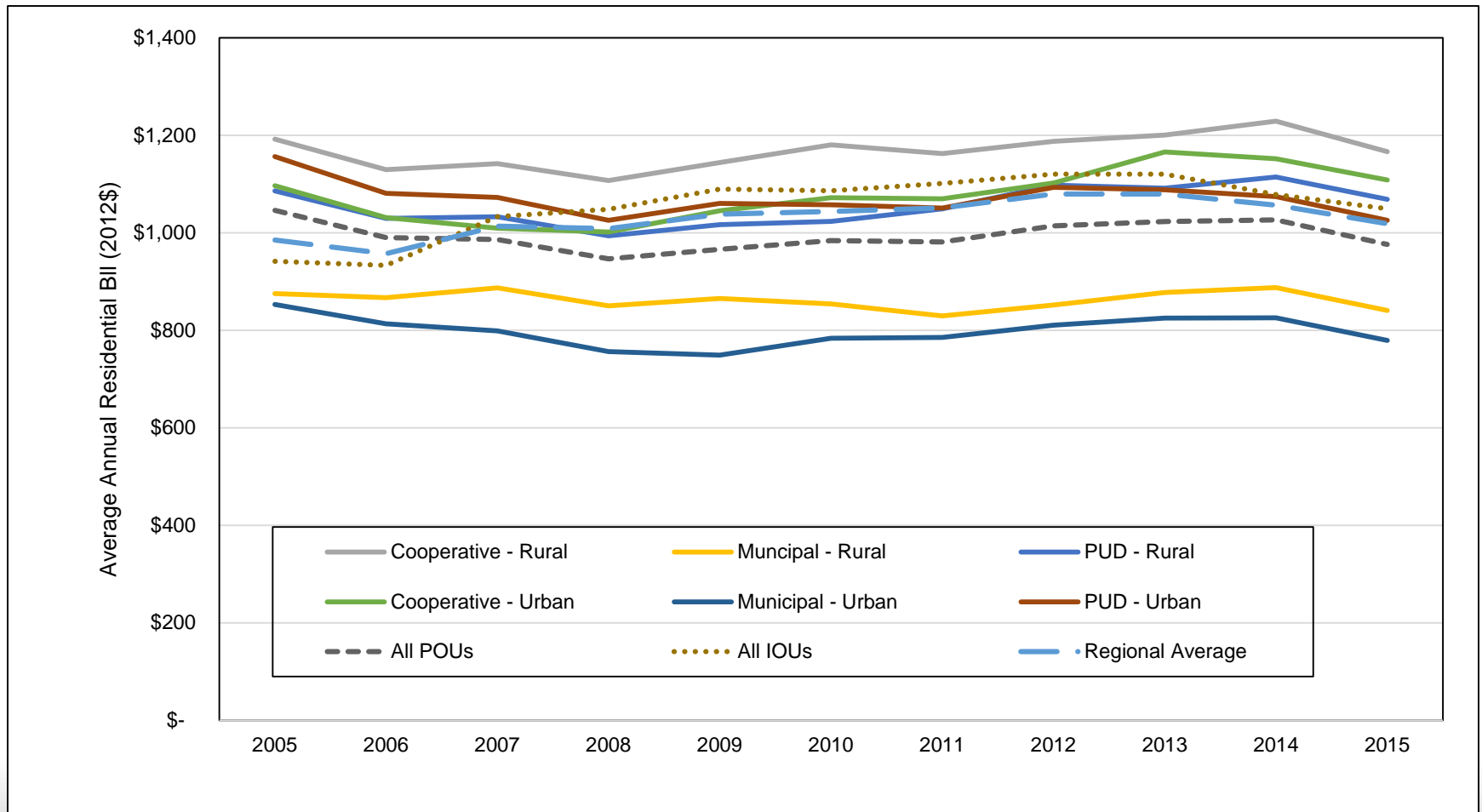
Key Finding: Over the past decade the average residential customer in the region paid an average of about \$1000 dollars per year for electricity



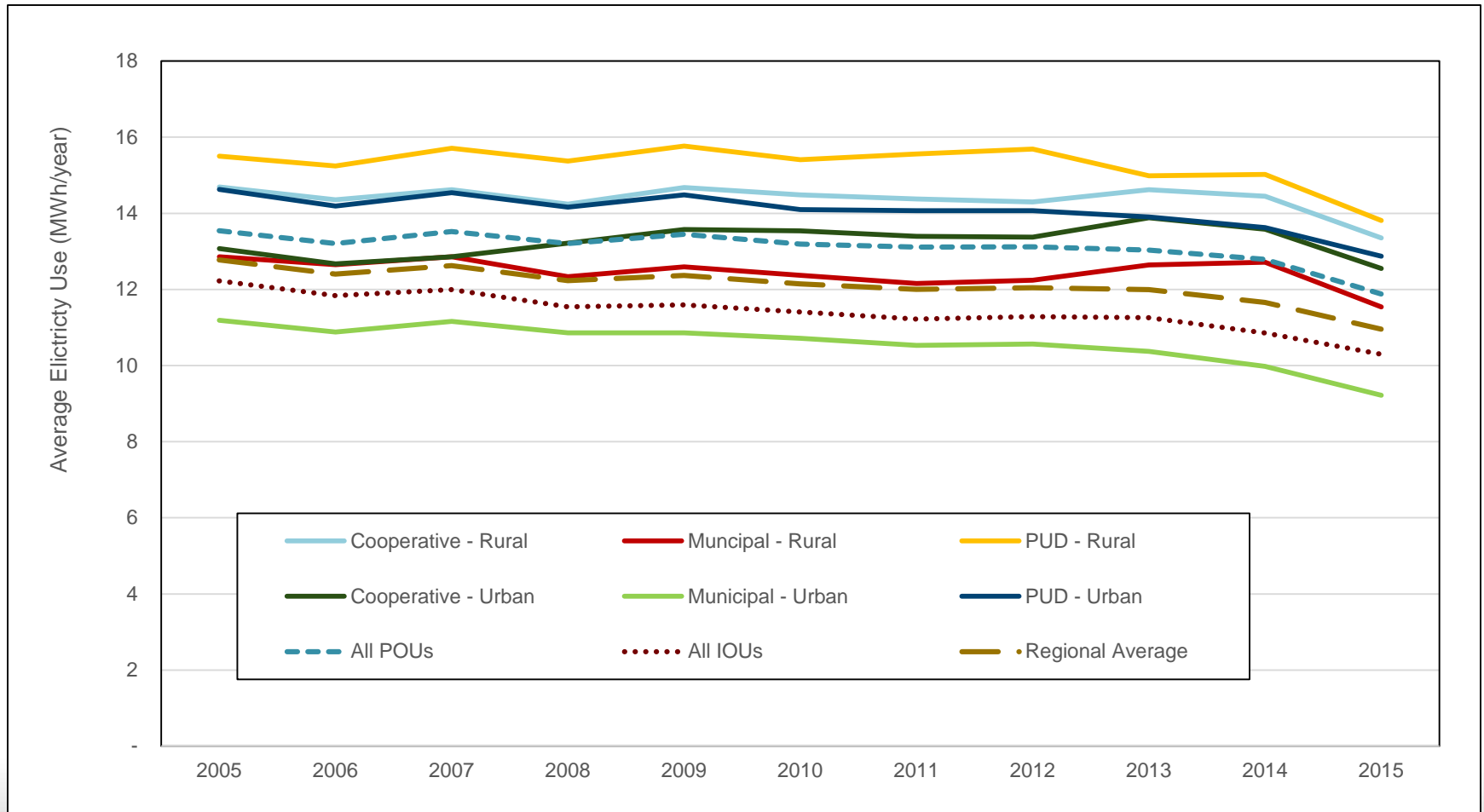
Key Finding: Residential customers of publicly owned utilities paid on average about \$1006 while residential customers of investor owned utilities customers on average paid about \$1067 annually for electricity



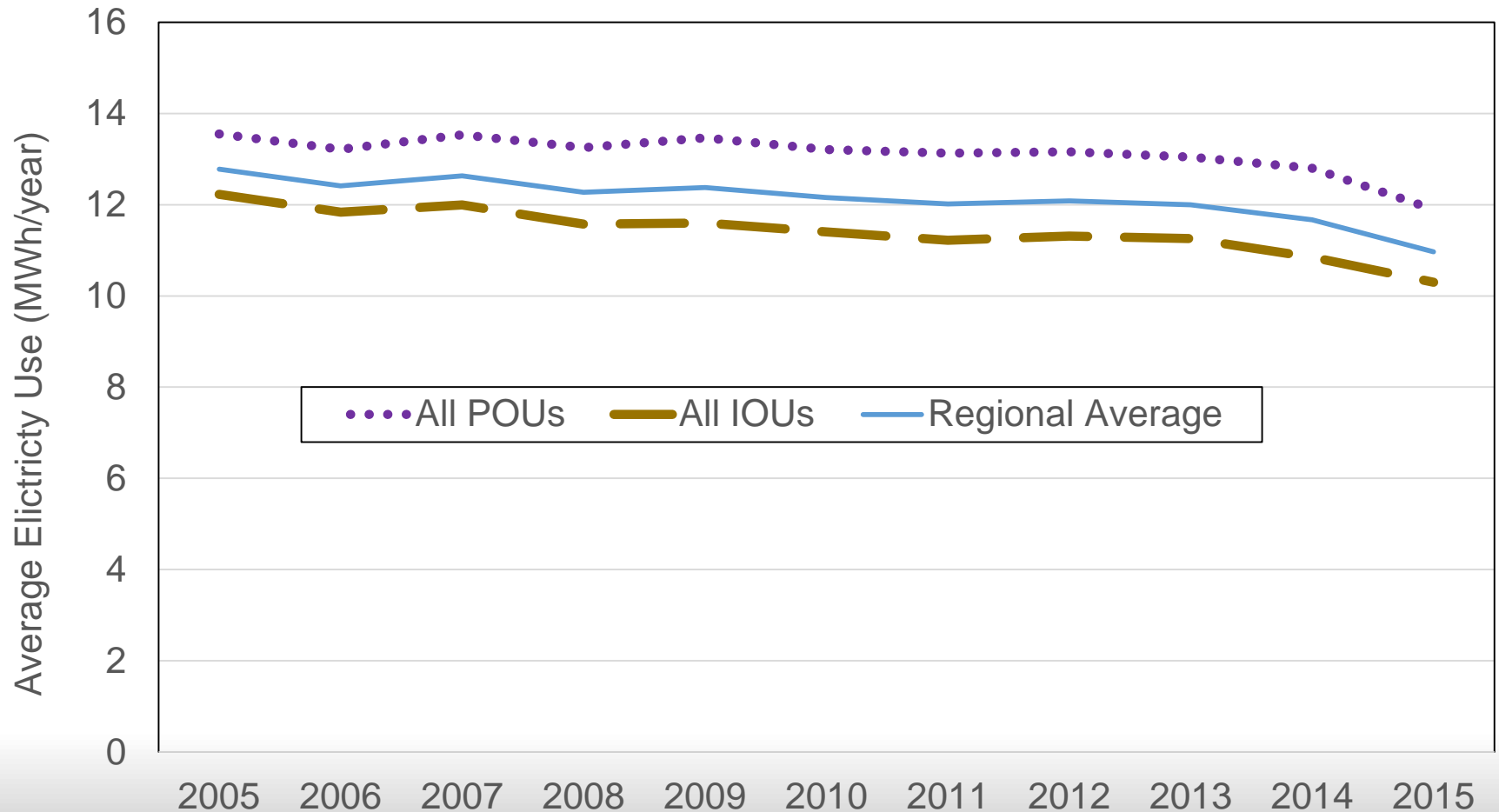
Key Finding: Over the past decade average annual residential electricity bills have declined slightly (Weather normalized, Adjusted for Inflation)



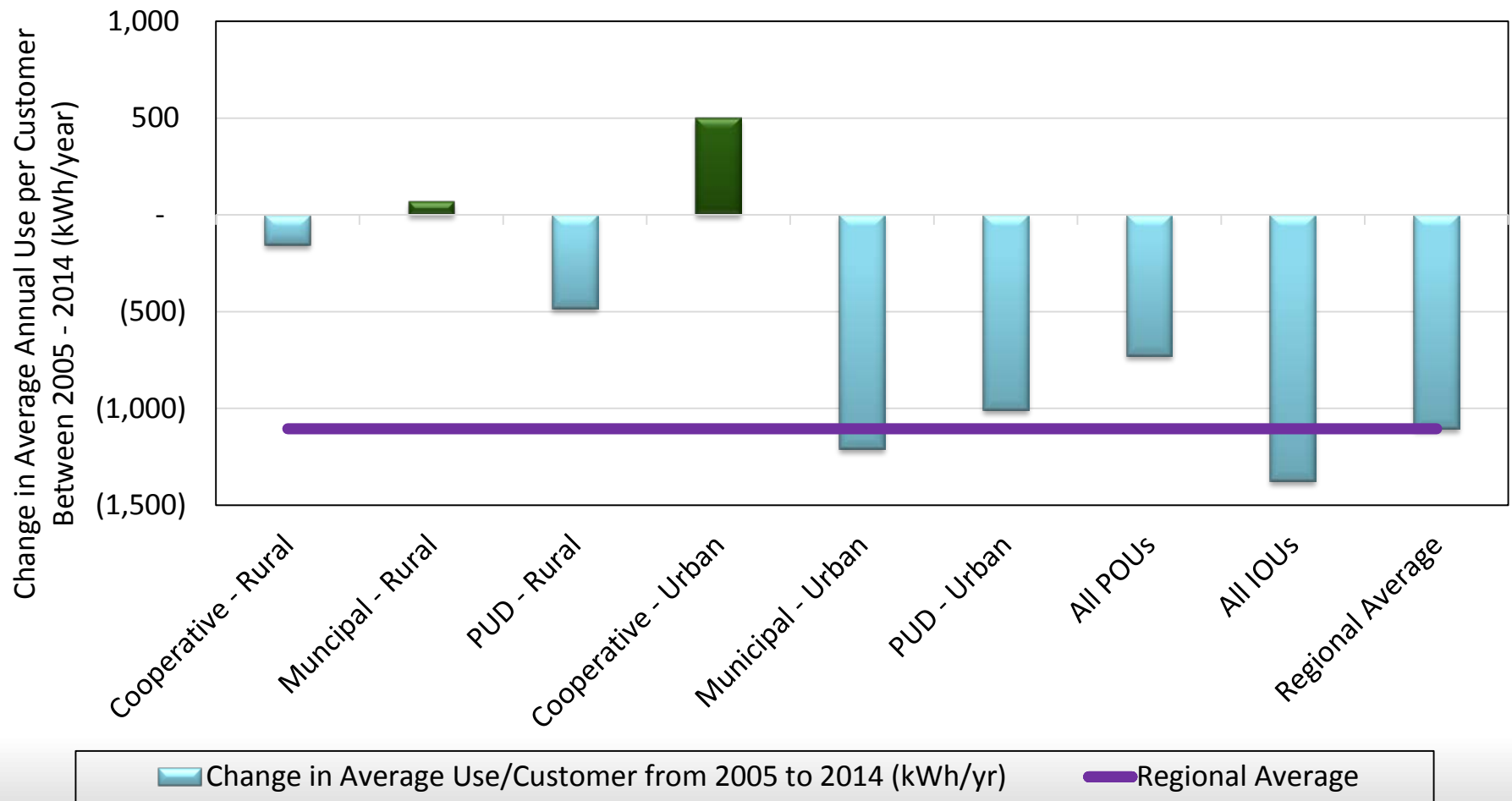
Key Finding: Over the past decade average annual residential electricity bills have declined slightly (Weather normalized, Adjusted for Inflation)



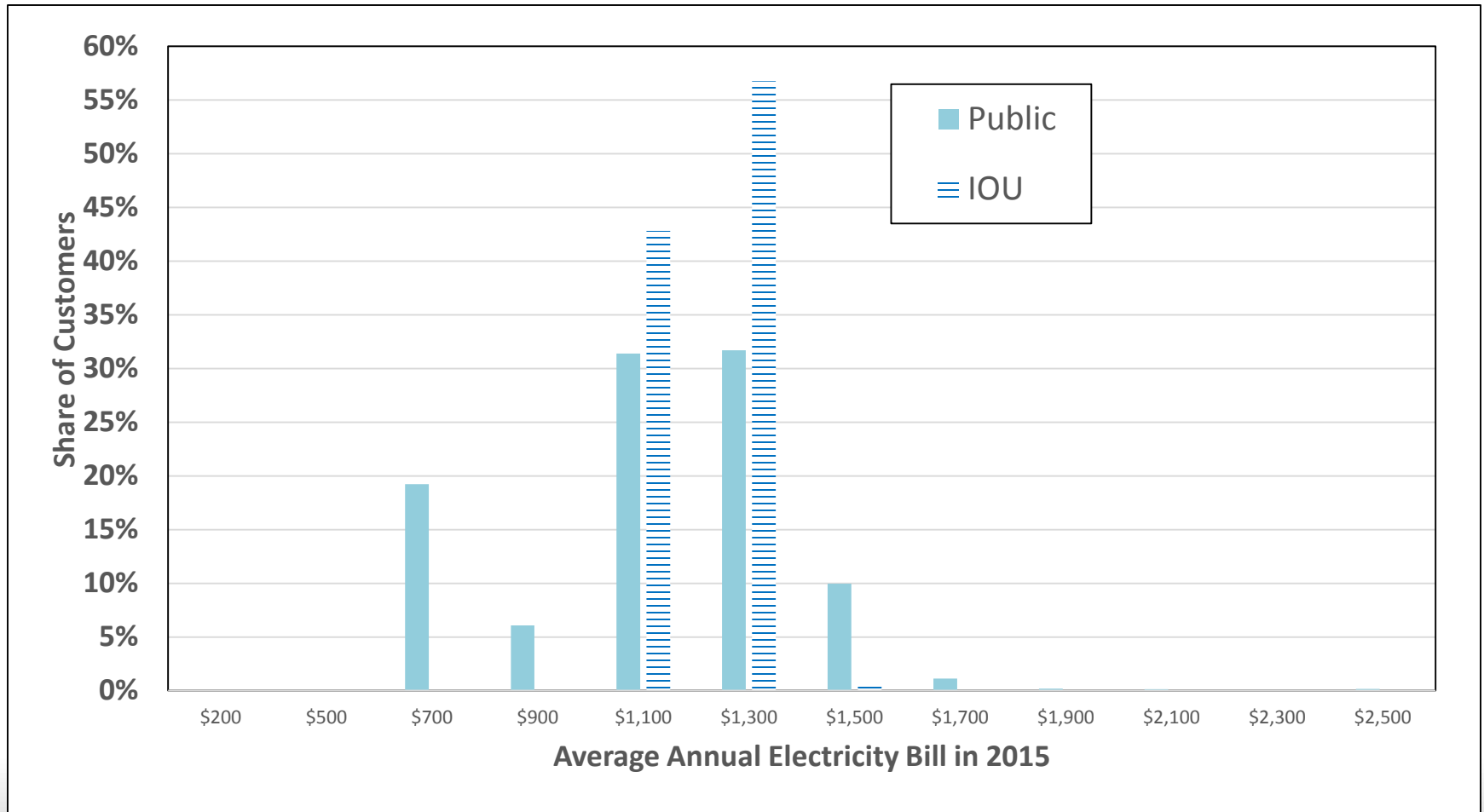
Key Finding: Average Annual Residential Electricity Use per Customer Declined From 2005 To 2015 for IOUs and “On Average” Across All Public Utilities (Weather Normalized)



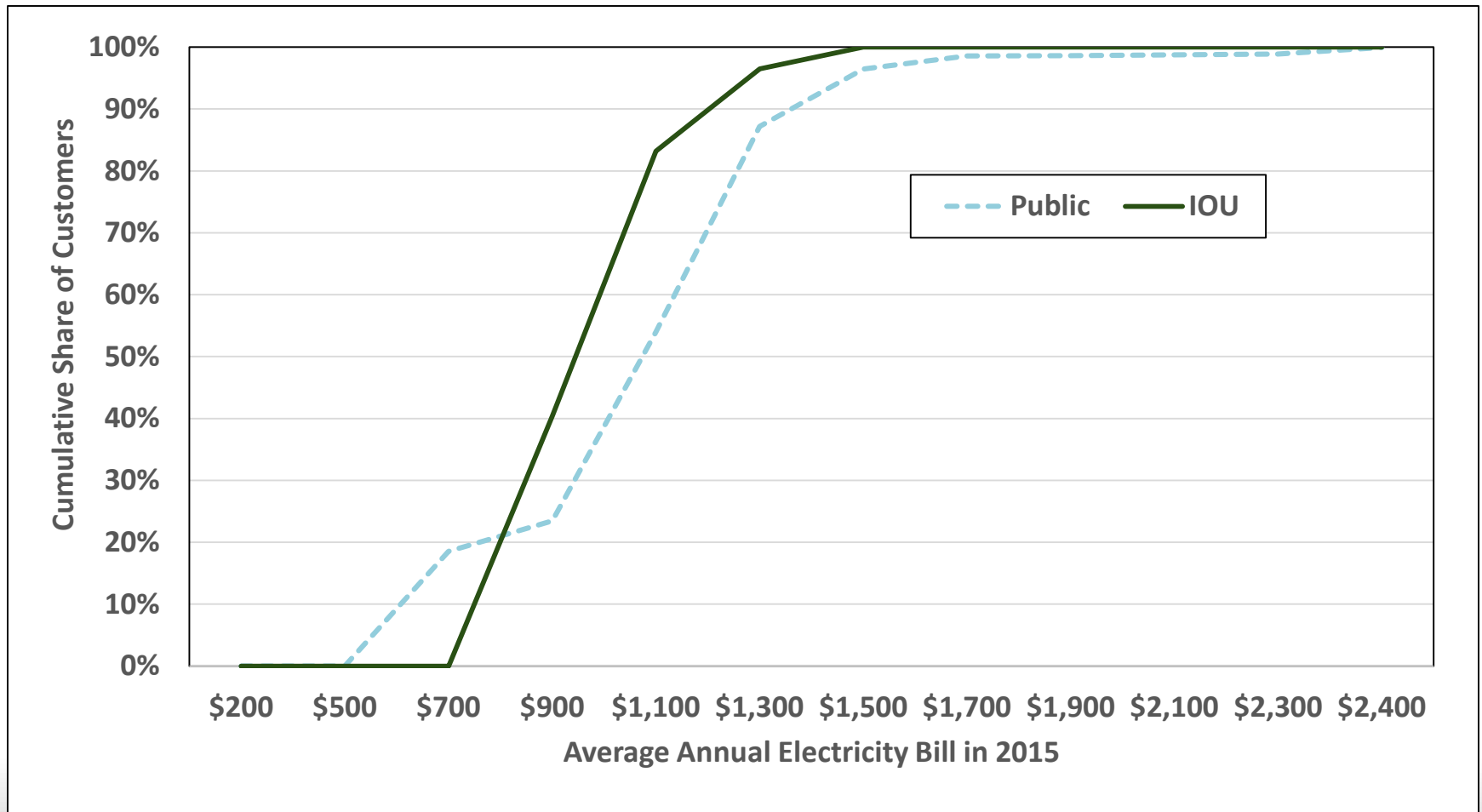
Key Finding: Not all utility types experienced a decline in average annual electricity use per residential customer



Key Finding: There Was a Large Variation in the Average Annual Residential Electricity Bill Among Both Publicly Owned and Investor Owned Utilities in 2015 (Nominal\$, Not Weather Normalized)

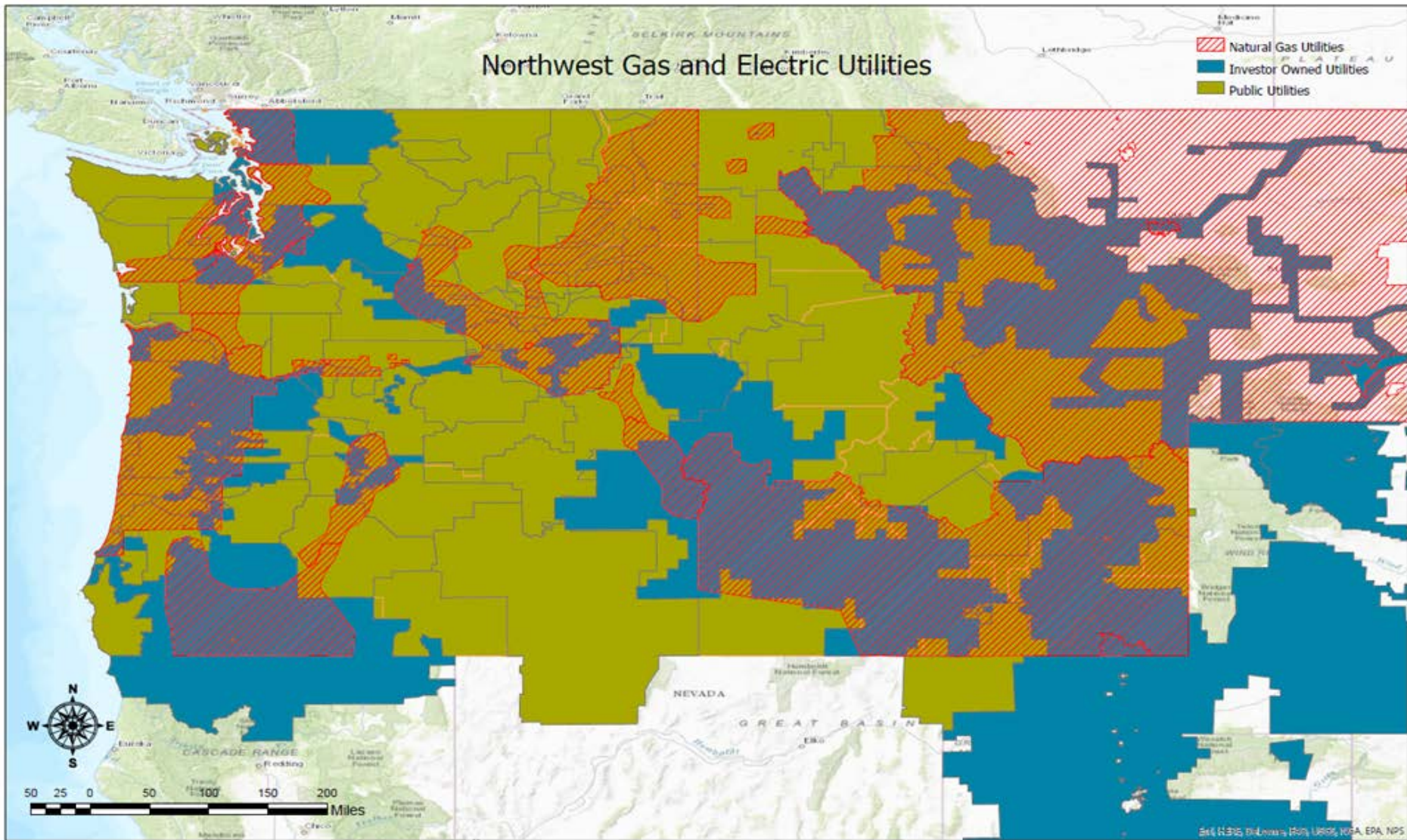


Key Finding: In 2015, 95% of the Average Residential Electric Bills Paid Public Utilities and IOUs Were Less Than \$1,300



Key Finding: Only Two Factors Contribute to Difference In Average Annual Electricity Use Between Public Utilities and IOUs

Factor	Yes	No
Access to natural gas	X	
Heating system efficiency		X
Vintage (i.e., age) of homes		X
Housing type mix (i.e., share of single family, multifamily and manufactured homes)		X
Historical energy efficiency	X	
Household Income and Level of Poverty		X



Access to Natural Gas

	Number of Electric Utility Residential Customers	% Customer with access to natural gas in Rural Area	% Customer with access to natural gas in Urban Area	Number of households <u>with</u> access to Natural Gas	Number of Households <u>without</u> access to Natural Gas
Coops	488,000	56%	21%	76%	24%
Muni's	787,000	9%	88%	98%	2%
PUDs	982,000	12%	20%	32%	68%
POUs	2,257,000	21%	44%	65%	35%
IOUs	3,210,893			71%	29%
Total	5,467,893			68%	32%

Natural Gas Availability Reduces Saturation of Electric Space and Water Heating, Resulting In Lower Average Use by Customers if IOUs (and Public Utilities Serving Urban Areas)

Space heating	IOU	Publics	REGION
Electric	22%	43%	30%
Natural Gas	53%	32%	45%
All others	25%	26%	25%

Water heating	IOU	Publics	REGION
Electric	52%	67%	59%
Natural Gas	46%	31%	40%
All others	2%	2%	1%

Finding – The average annual electricity use per residential customer served by public utilities is higher because they have a higher saturation of electric space and water heating than those served by investor owned utilities

Key Finding: There are only minor variations in electric heating system types saturations between public utilities and IOUs

Electric Heating System Technology	Market Share of Technology		
	IOU	Public	Region
Ductless HP	3%	2%	3%
Electric Baseboard/Zonal	47%	38%	42%
FAF/electric	19%	19%	19%
Heat Pump	31%	40%	36%
Total Electric	100%	100%	100%

Finding – The higher average annual electricity use of residential customer served by public utilities compared to those served by investor owned utilities is not due to differences in the mix of electric space heating technologies

Key Finding: There are only minor variations in housing type saturations between public utilities and IOUs

Housing Type	IOU	POU	Total
Single Family	77%	74%	76%
Multi family	13%	16%	14%
Manufactured Housing			
Multi-section	7%	7%	7%
single section	3%	3%	3%

Finding – The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities is not due to differences in the composition of housing stock in their service areas.

There are only minor differences in the vintages of housing found in Public Utility and IOU service areas

	Pre 1980	1980- 1992	1993- 2006	Post 2006
Single Family -IOUs	62%	17%	16%	5%
Single Family - POU	65%	15%	14%	5%
Manufactured Housing -IOU	35%	32%	27%	3%
Manufactured Housing -POU	35%	34%	27%	3%

Finding - The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities is not due to differences in the vintage of housing stock in their service areas.

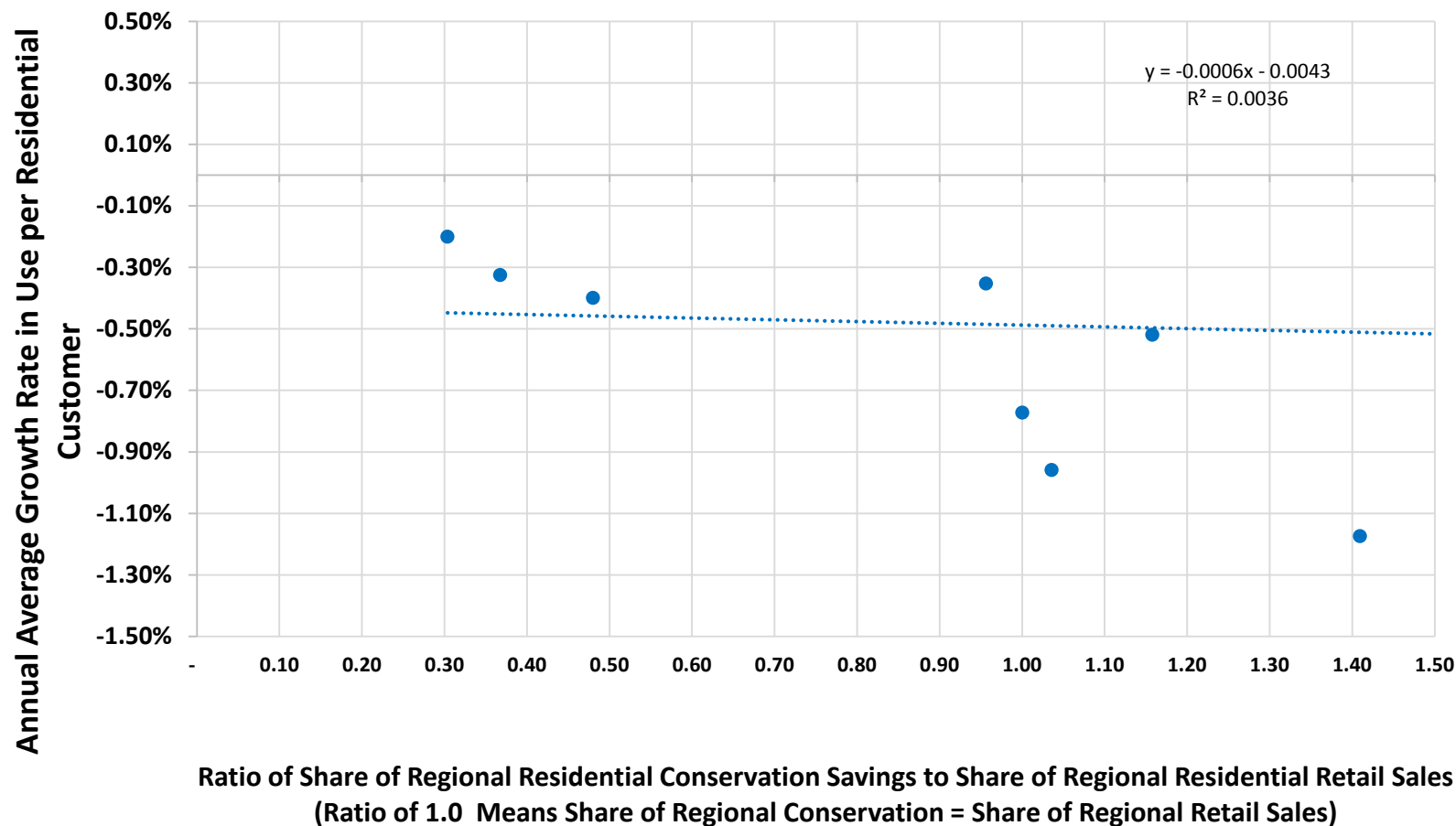
The relationship between conservation acquisitions and changes in the average annual electricity use per customer from 2005 to 2015 appears to have a significant impact on the direction and magnitude of the change in average annual customer bills

	Share of Residential Customers	Share of Residential Sector Retail Sales	Share of Regional Conservation Acquisitions	Average Annual Growth Rate in Electricity Use per Customer
Rural	14%	17%	7%	
Cooperative	7%	9%	3%	-0.20%
Municipal	2%	2%	1%	-0.32%
PUDs	5%	7%	3%	-0.40%
Urban	27%	28%	36%	
Cooperative	2%	2%	3%	0.34%
Municipal	13%	11%	16%	-1.17%
PUDs	13%	15%	17%	-0.52%
All Publics	42%	45%	43%	-0.35%
Investor Owned	58%	55%	57%	-0.96%
Regional Average	100%	100%	100%	-0.77%

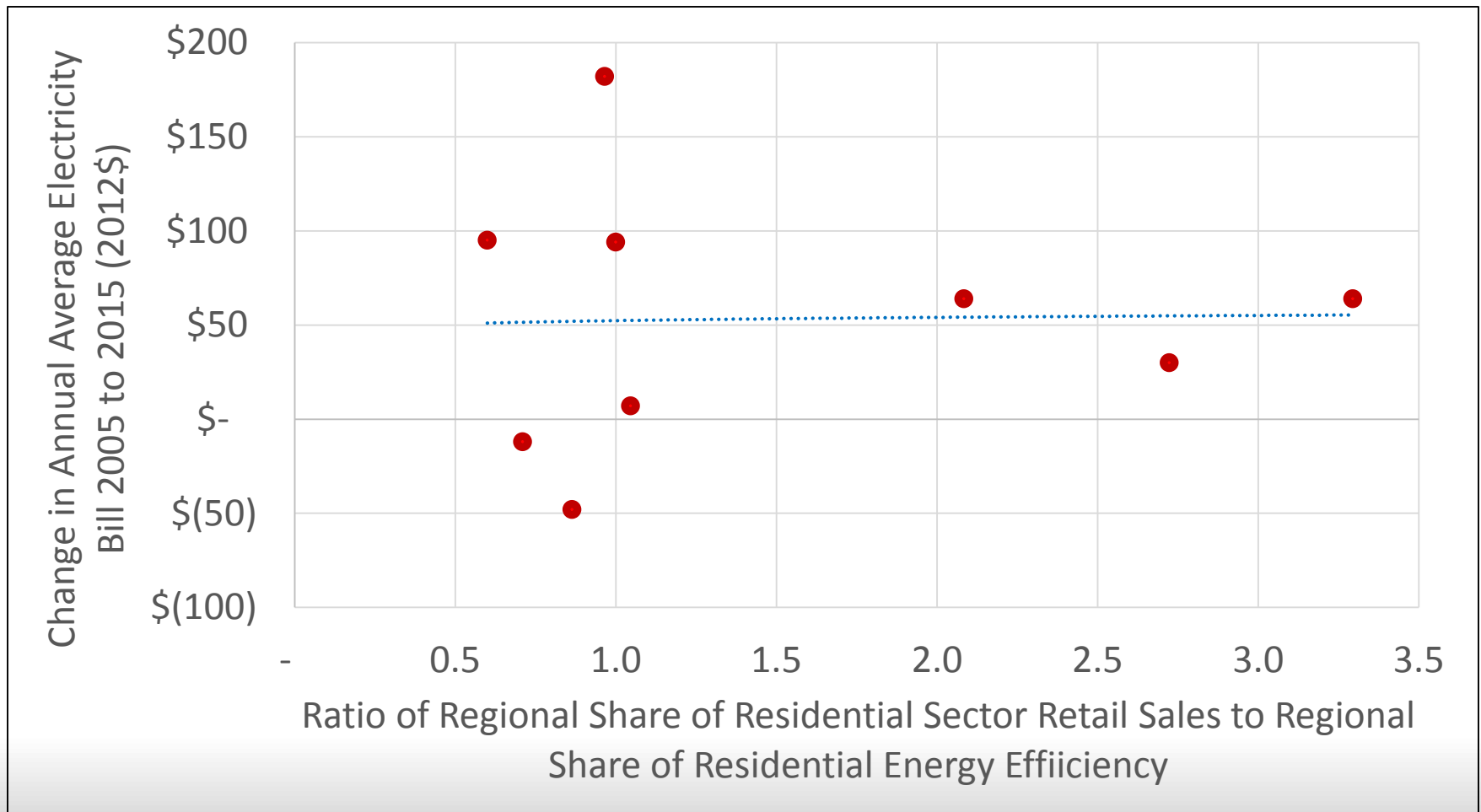
Change in Average Annual Residential Sector Electricity Bill 2005 to 2015

Utility Ownership and Service Area Type	Nominal dollars	Real (2012\$)
Rural		
Cooperatives	\$ 257	\$ 64
Municipals	\$ 170	\$ 30
PUDs	\$ 239	\$ 64
Urban		
Cooperative	\$ 272	\$ 95
Municipals	\$ 122	\$ (12)
PUDs	\$ 133	\$ (48)
All POU's	\$ 173	\$ 7
All IOUs	\$ 339	\$ 182
Regional Average	\$ 270	\$ 94

Key Finding: Higher levels of energy efficiency resulted in smaller increases in the growth in average annual electricity use per residential customer between 2005 and 2015



Key Finding: Lower levels of conservation generally resulted in larger increases in annual electricity bills between 2005 and 2015



Key Finding: Median Incomes In Urban Areas Are Higher Than Those in Rural Areas, Regardless of Utility Ownership

	Median income	Number of Households
Cooperative	45,310	529,695
Rural	44,728	462,909
Urban	55,528	66,786
Municipal	59,463	457,940
Rural	46,202	36,743
Urban	60,897	421,197
PUDs	46,797	540,042
Rural	43,661	185,082
Urban	51,024	354,960
All Public Utilities	50,523	1,527,677
Investor Owned	53,183	3,180,731
Grand Total	49,999	4,915,996

Finding– The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities or those serving urban and rural area does not appear to be related to differences in income.

Key Finding: While Public Utilities serve a larger share of customers with incomes at or below federal poverty levels, investor owned utilities serve nearly double the number of people with income below federal poverty levels

Utility Type	Population	Population in Poverty	Share of Population in Poverty
IOU	8,248,525	1,165,451	14%
Public	3,817,408	621,408	16%
#N/A*	485,016	72,496	15%
Grand Total	12,550,949	1,859,355	15%

Finding: The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities or those serving urban and rural area does not appear to be related to differences in income or levels of poverty.

Summary

- Average residential bill over the past decade has been about \$1000 dollars.
- Annual consumption for IOUs is lower than aggregate POUs by 15%
- IOU rates are higher than POUs, and bills are about \$5/month higher than aggregate POUs
- Variation in bills is higher among POUs than between POUs and IOUs.
- Major contributing factors are, availability of natural gas and level of conservation acquisition.

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December 2016

Northwest Residential Electric Bills

A report on residential electricity use, annual bills, income, and poverty by utility type and service area characteristics

Introduction

At the March 2016 Power Committee meeting staff presented an analysis of recent trends in gross state product and employment as indicators of the overall condition of the regional economy. Staff also presented data on both actual and weather-normalized regional electricity sales/loads, utility revenues, and average prices over the past several years. During the presentation, Council members asked staff to provide additional information on trends in average residential electricity use and bills, particularly focusing on the differences between the residential bills for the region's investor owned utilities (IOUs) and publicly owned utilities. This report is a follow-up to that presentation using sales and revenue data for 133 utilities in the Council's footprint.

In July 2016, Council released this paper for comment. Total of nine comments from various organizations and individuals were received. A summary of these comments is available under a separate cover. For this final report, 2015 electric sales, revenues and bills data was incorporated in the analysis. Also, section of the report dealing with contributing factors to differences in bills and consumption was enhanced with a brief discussion on natural gas availability in the region. Conservation achievements for 2010-2015 were also updated.

Summary of Findings

This paper investigates the relationship between average residential customer electric bills, average use per customer, and average revenue per kilowatt-hour for investor-owned and publicly owned utilities in the region. This analysis found that after normalizing for year-to-year variations in weather and adjusting for inflation:

- Over the past decade the average annual residential customer in the region paid just over \$1,000 per year for electricity.
- Despite the fact that the average annual use of electricity for customers served by public utilities is nearly 15 percent greater than those served by investor-owned utilities, customers of public utilities paid about 5 percent less or about \$60 per year for electricity than those served by investor-owned utilities. Residential customers of publicly owned utilities paid on average about \$1010 annually for electricity over the past 11 years while residential customers of investor-owned utilities paid on average about \$1,070 annually for electricity.
- The primary source of the difference in average annual electricity consumption per household between publicly owned and investor-owned utilities is that a much larger share of public utility customers use electricity for space and water heating than do customers of investor-owned utilities. The higher penetration of electric space and water heating in public utility service areas is due to more limited access to natural gas and the historic lower cost of electricity in their service areas.
- There are minor variations between residential customers served by publicly owned utilities and those served by investor-owned utilities with respect to the technologies used for space heating, the vintage and mix of housing stock, and personal income. However, none of these factors appears to produce significant differences in annual electricity use.
- There appears to be a strong correlation between the trends in energy efficiency achievements, annual average use per residential customer, and average annual bills. As a group, those utilities whose share of regional residential conservation achievements aligned closely with their share of regional residential retail sales (or customers) experience slower growth in both average annual electricity use per customer and smaller increases in average annual bills per customer.
- While in 2014 the share of people at or below the poverty level was higher in areas served by public utilities than in areas served by investor-owned utilities (16 percent vs. 14 percent), the absolute number of people with incomes at or below the poverty level is nearly double in areas served by investor-owned utilities, which generally have many more customers than publicly owned utilities.
- This report focuses solely on the costs paid by residential customers for electricity. That is, it does not reflect the total energy bill *because* the annual cost of other non-electric usage (natural gas, oil, propane, and wood) is not incorporated in this analysis. Because there are significant differences in the share of natural gas used for space and water heating, particularly between utilities serving urban and rural areas, the total *average energy* bill is different from utility to utility.

Report Organization

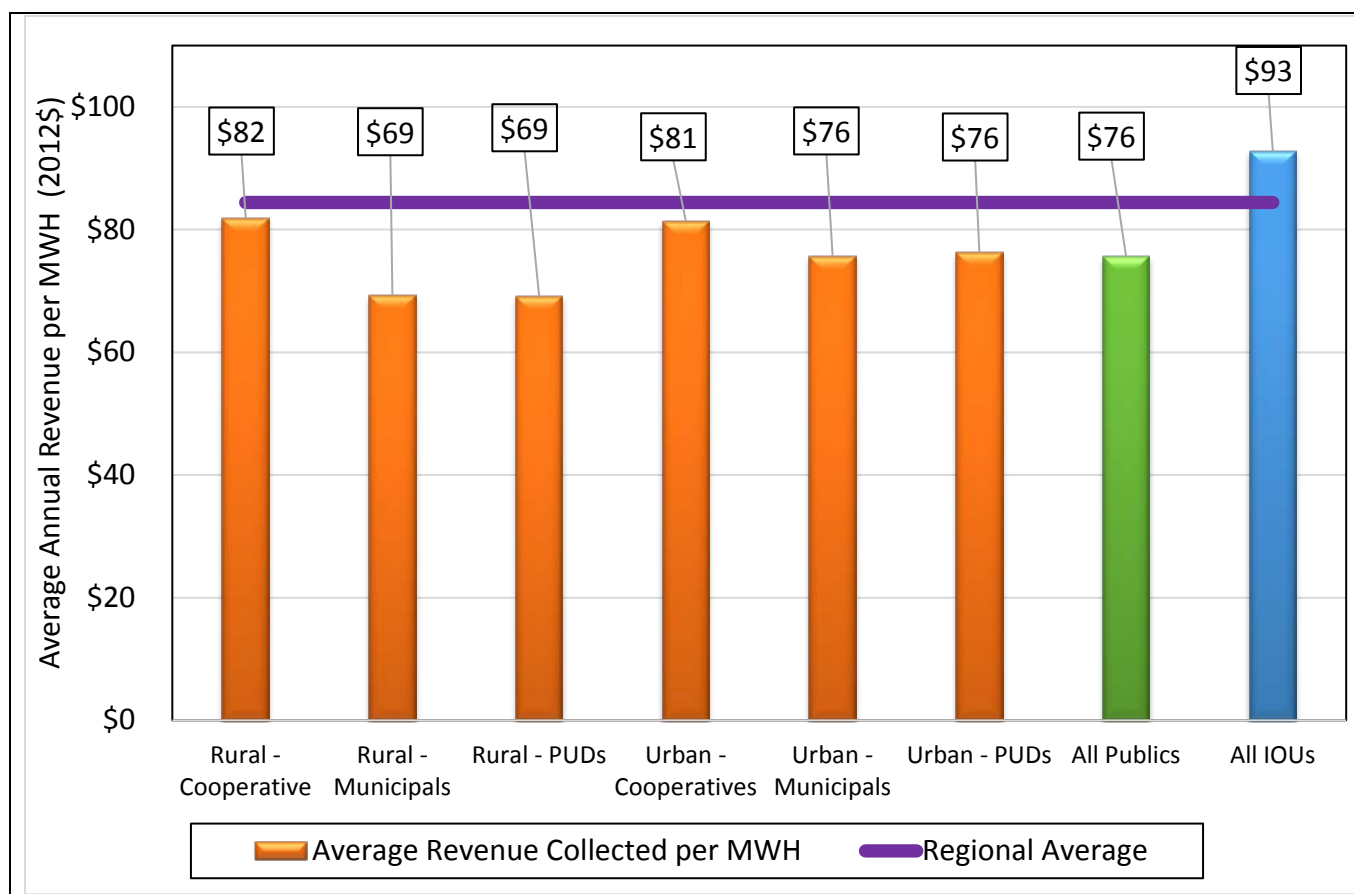
This report is organized in three sections.

- Section 1 discusses recent trends in the factors that directly affect average residential electricity bills (i.e., annual electricity consumption and average cost per megawatt-hour of electricity).
- Section 2 provides a detailed comparison of average annual use (demand) for electricity, average retail revenue per megawatt-hour and major factors contributing to the difference in demand for electricity
- The appendix provides economic data and information about the utilities in each ownership category.

Key Factors Affecting Average Residential Electricity Bills

The average residential electric bill consists of two components, average revenue per unit of electricity sales and annual electricity consumption. Figure 1 shows the inflation- and weather-adjusted average revenue per megawatt-hour across utility ownership types. The regional average retail revenue per megawatt-hour was \$84 dollars (2012\$) for the years 2005 - 2015. At \$93 per megawatt-hour, the average revenue for IOUs was higher than the regional average while the \$76 average revenue per megawatt-hour for public utilities was about 12 percent lower than the regional average.

Figure 1 – Average Revenue Collected per Megawatt-Hour of Retail Sales
(Adjusted for Inflation)

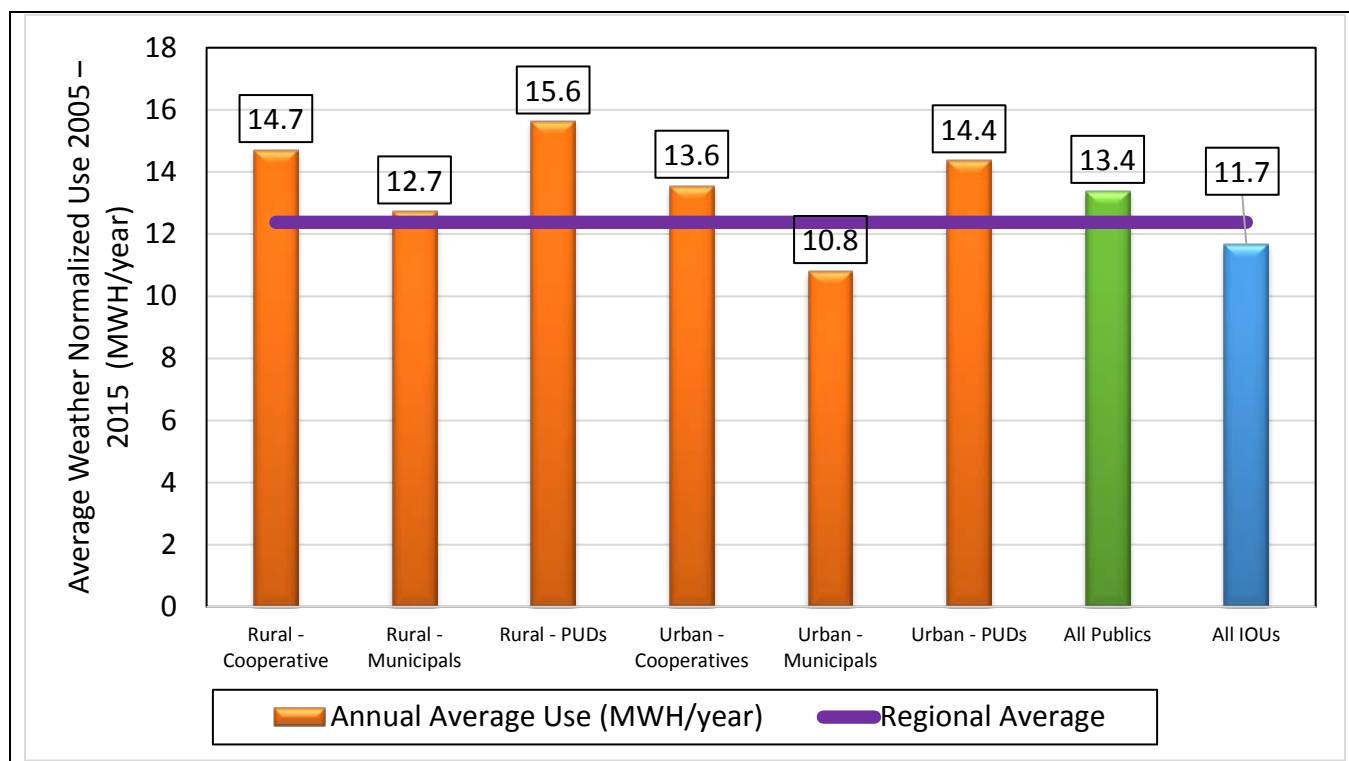


From Figure 1 it can also be seen that there is significant variance in the average revenue per megawatt-hour collected by different types of public utilities and service area composition. For example, PUDs serving rural areas had the lowest average cost per megawatt-hour (\$69/MWh) while cooperatives serving urban areas had the highest average cost (\$81/MWh) over the 11-year period from 2005 through 2015.

The second factor that directly impacts the average residential consumer's electric bill is average annual electricity consumption. Figure 2 shows the weather-normalized average annual electricity use per household for 2005 through 2015 for various utility types.

On a regional basis, average weather-normalized annual use was 12.4 megawatt-hours per household over the past 11 years. Residential customers of IOUs used, on average, 11.7 megawatt-hours per year while residential customers of publicly owned utilities used, on average, 13.4 megawatt-hours per year or about 15 percent more. Figure 2 also shows that there is greater variation across the different types of publicly owned utilities than there is between the average IOU customer and the average public utility customer. Residential customers of Public utility districts serving rural areas used 15.6 megawatt-hours per year whereas residential customers of municipal utilities serving urban areas used 10.8 megawatt-hours per household per year.

Figure 2 – Annual Average Use per Residential Customer
(Weather Normalized) ¹



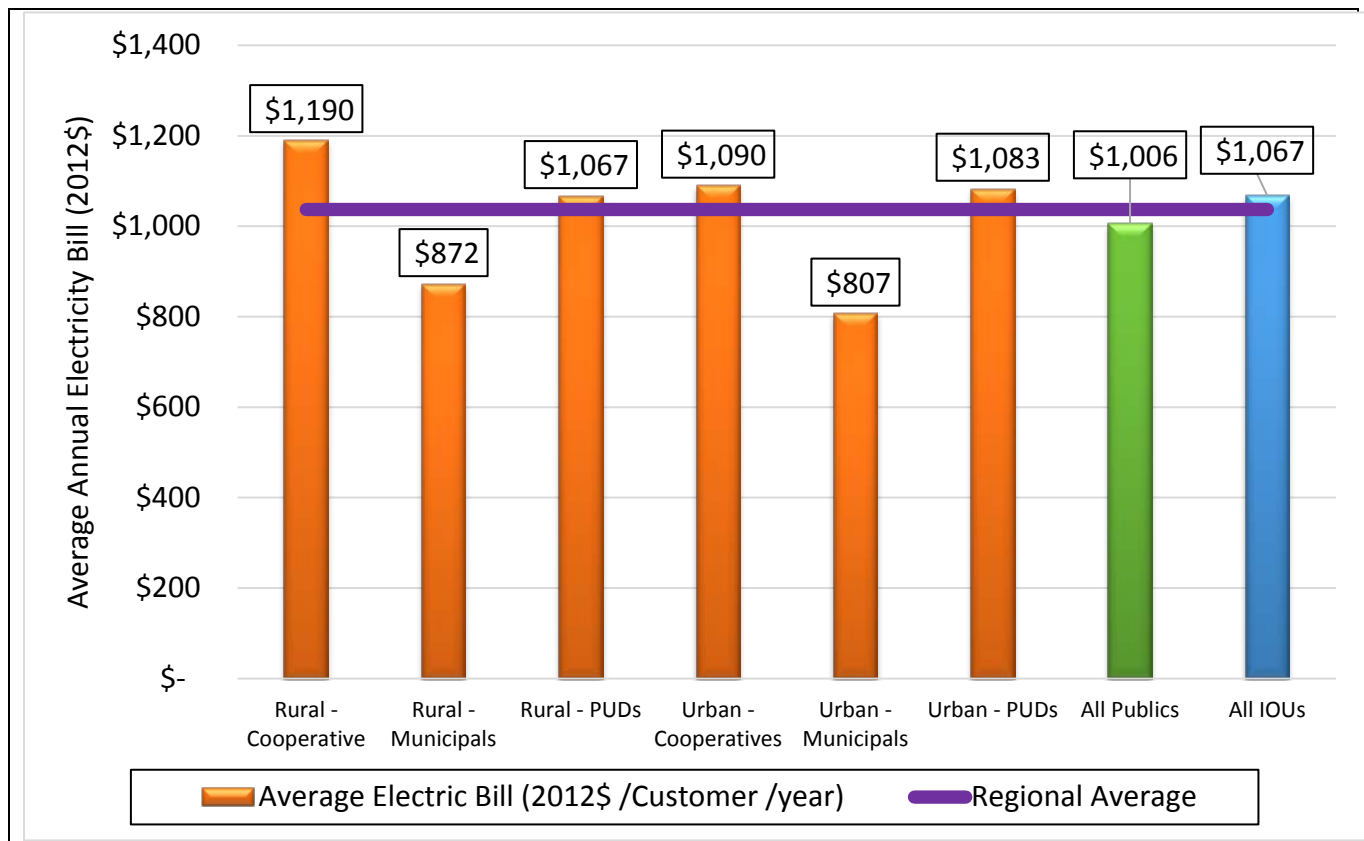
A customer's annual electric bill is a function of both the annual average cost per megawatt-hour and the customer's annual electricity use. To derive the average annual electricity bill,

¹ Annual electricity use data used to compute average electricity bills has been normalized for year-to-year variations in weather by applying the regional average temperature-to-load relationship to each utility. This likely both overstates and understates the year-to-year impact on electricity sales, depending upon the saturation of electric heating in a utility's service area. For those utilities that have greater than the regional average saturation of electric heating, this adjustment will understate the year-to-year variation in average electricity bills due to weather, and for utilities that have less than the regional average saturation of electric heating it will overstate this variation. This fact should be considered when comparing the trend in annual electricity bills of utilities serving rural areas, which tend to have higher saturation of electric heat, with utilities serving urban areas, which tend to have lower electric heat saturation.

the Council multiplied the average annual revenue per megawatt-hour for each utility by the average electricity use per residential customer.

Figure 3 shows that on average over the last 10 years, the average residential electricity bill was about \$1,000 per year. Residential customers of IOUs paid slightly more than the regional average and public utility customers paid slightly less. The difference between IOU and publicly owned utilities was about \$60 per year, or about \$5 per month. Figure 3 also reveals that the difference in average bills among residential customers of publicly owned utilities was greater than the difference in average bills among investor-owned utilities.

Figure 3 – Average Annual Residential Electric Bills
(Weather-Normalized and Inflation-Adjusted)



Trends in Key Factors Affecting Average Residential Electricity Bills

Figure 4 shows the inflation-adjusted average annual revenue per megawatt-hour collected from residential retail sales in the region from 2005 through 2015. As can be seen, over the past decade residential customers paid on average about \$84 per megawatt-hour. Over this period, the average cost per megawatt-hour increased from around \$77 to \$92, or by about 19 percent.

Figure 4 – Average Revenue per Megawatt-Hour of Residential Retail Sales 2005 – 2015 (Inflation-Adjusted)

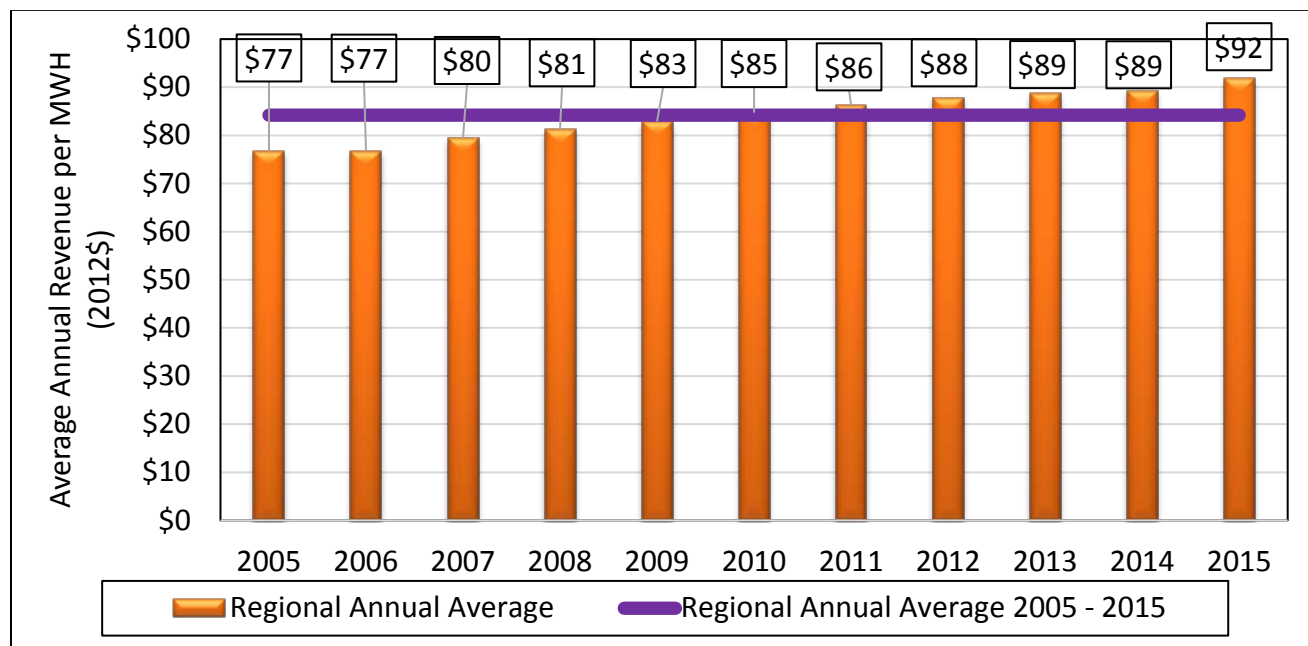


Figure 5 shows the weather-normalized average annual electricity use per residential customer from 2005 through 2015. This figure shows that over the past decade the average residential customer in the region used 12.1 megawatt-hours of electricity annually. However, Figure 5 also shows that the average annual electricity use per residential customer decreased from 12.8 megawatt-hours per year in 2005 to 11.0 megawatt-hours per year in 2015. This equates to a decline of over 1.8 megawatt-hour per year per household or nearly 15 percent.

Figure 5 – Weather-Normalized Regional Average Annual Electricity Use per Residential Customer from 2005 Through 2015

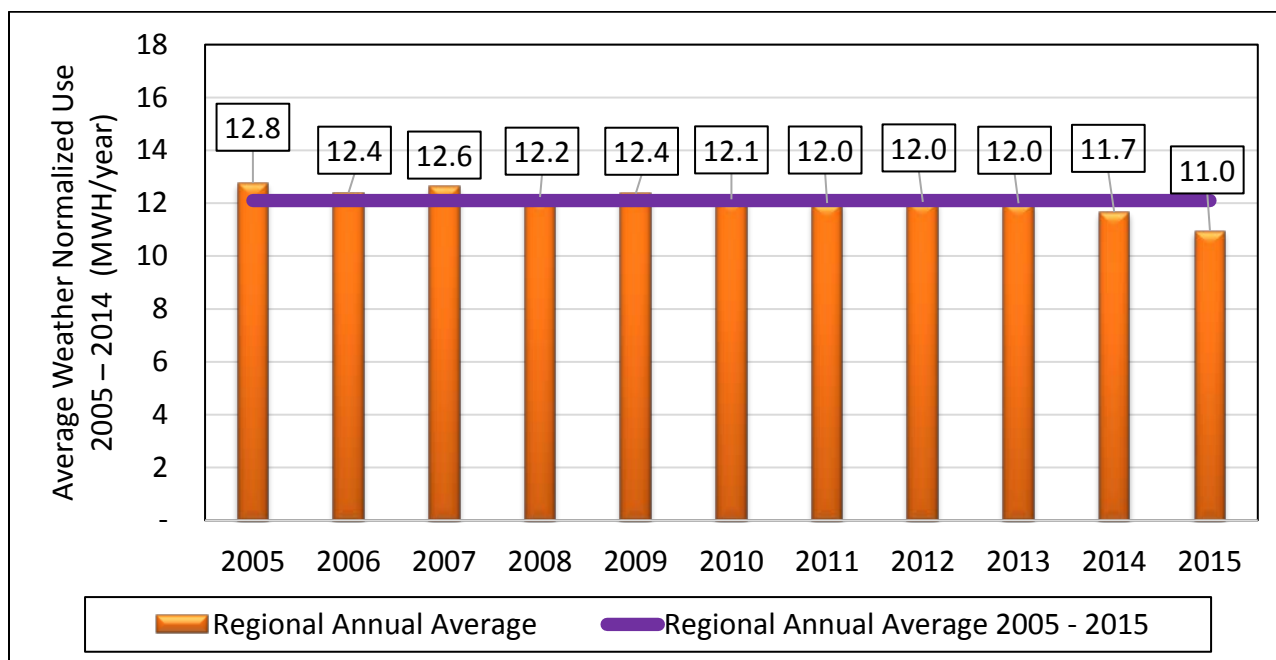
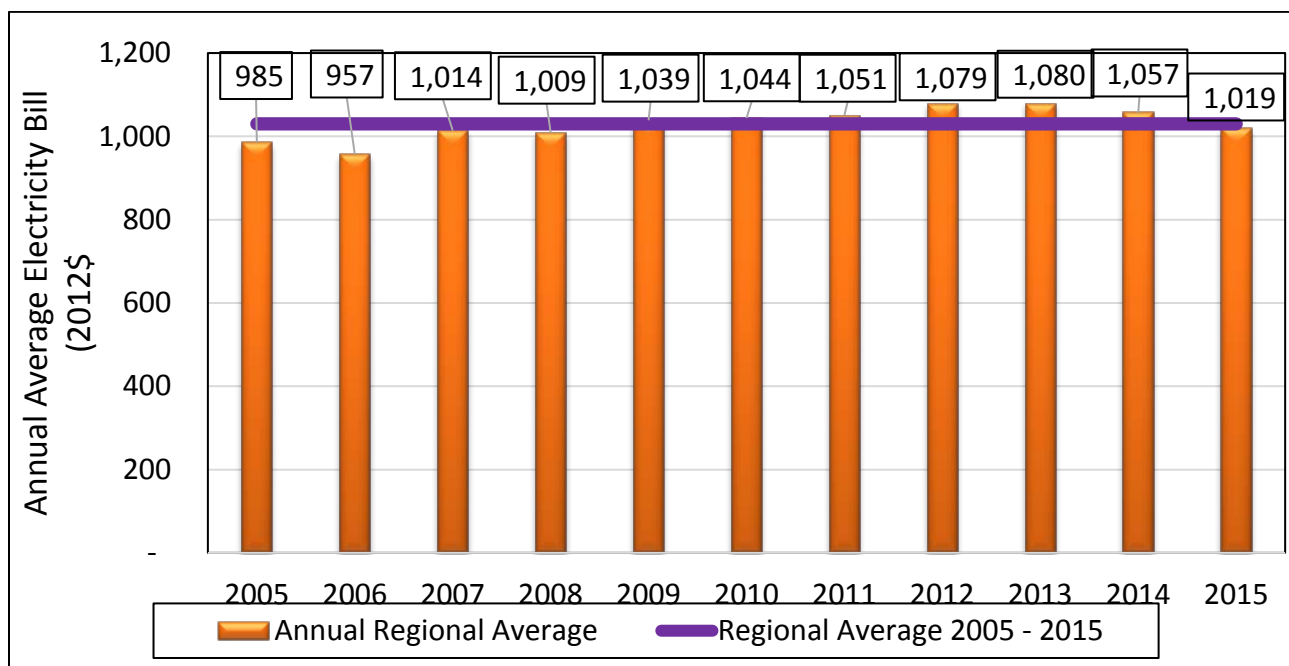


Figure 6 shows the trend in regional average annual residential electricity bills from 2005 through 2015. As can be seen from this figure, after adjusting for inflation the regional annual average residential electricity bill increased from \$985 in 2005 to \$1,019 in 2015. This 3-percent bill increase is less than the 19 percent increase in the average cost per megawatt-hour of electricity over this timeframe because the bill increase was partially offset by a nearly 15-percent decrease in the average annual use per customer.

Figure 6 - Average Annual Residential Electricity Bill from 2005 through 2015.
(Weather-Normalized and Adjusted for Inflation)



Variations in Trends in Key Factors Affecting Average Residential Electricity Bills by Utility Ownership and Service Area Characteristics

Figure 7 shows the annual weather-normalized electricity use per residential customer from 2005 through 2015 for publicly owned and investor owned utilities as well as the regional average. As was stated previously, on a regional average basis the average use per residential customer declined from 12.8 MWh per year to 11.0 MWh per year or just over 1,800 kilowatt-hours per household between 2005 and 2015. The average residential customer use of electricity declined slightly in investor-owned service territories and on average across all public utility service areas. After adjusting for year-to-year variations in weather, the average annual electricity use of residential customers in public utility service areas declined from 13.6 MWh per year to 11.9 MWh per year, or by 1700 kilowatt-hours per year between 2005 and 2015. The average annual electricity use of residential customers of investor owned utilities declined from 12.2 MWh per year to 10.3 MWh per year, a reduction of 1,900 kilowatt-hours per year.

Figure 7 – Average Annual Residential Electricity Use per Customer for Public and IOUs
2005 – 2015 (Weather Normalized)

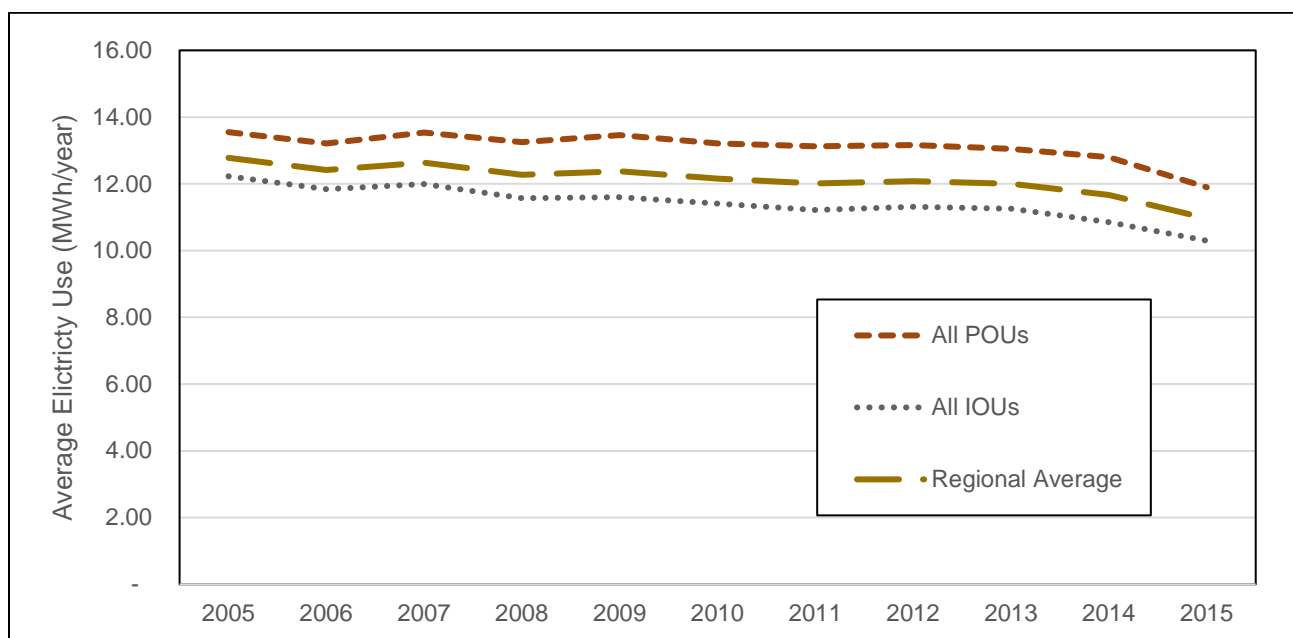


Figure 8 shows the annual weather normalized electricity use per residential customer from 2005 through 2015 by utility ownership type and service area characteristic. As was stated previously, on a regional average basis the average use per residential customer declined between 2005 and 2015 as did the average residential customer use of investor owned service territories and on average across all public utility service areas.

Figure 8 – Average Annual Electricity Use per Residential Customer from 2005 through 2015 by Utility Ownership Type and Service Area Characteristic (Weather Normalized)

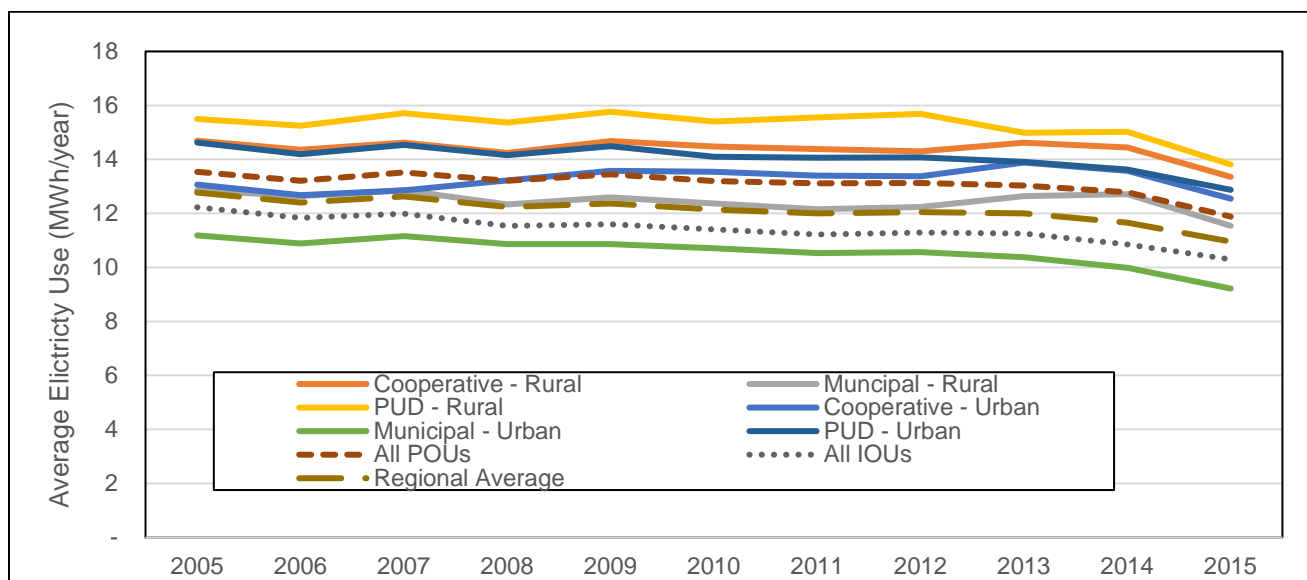


Figure 9 shows the trend in average revenue collected per megawatt-hour from 2005 through 2015 by utility ownership type and service area characteristic (i.e., urban vs. rural) after adjusting for inflation. From Figure 9 it is clear that the trend in average revenue collected per megawatt-hour differs across utility ownership and service area types. For example, between 2005 and 2015 the average residential customer of investor-owned utilities increased from less than \$80 per megawatt-hour to almost \$100 per megawatt-hour. In contrast, the average revenue collected per megawatt-hour for PUDs with rural service areas remained nearly constant throughout this period.

Figure 9 – Average Annual Revenue per Megawatt-hour from 2005 through 2015 by Utility Ownership Type and Service Area Characteristic

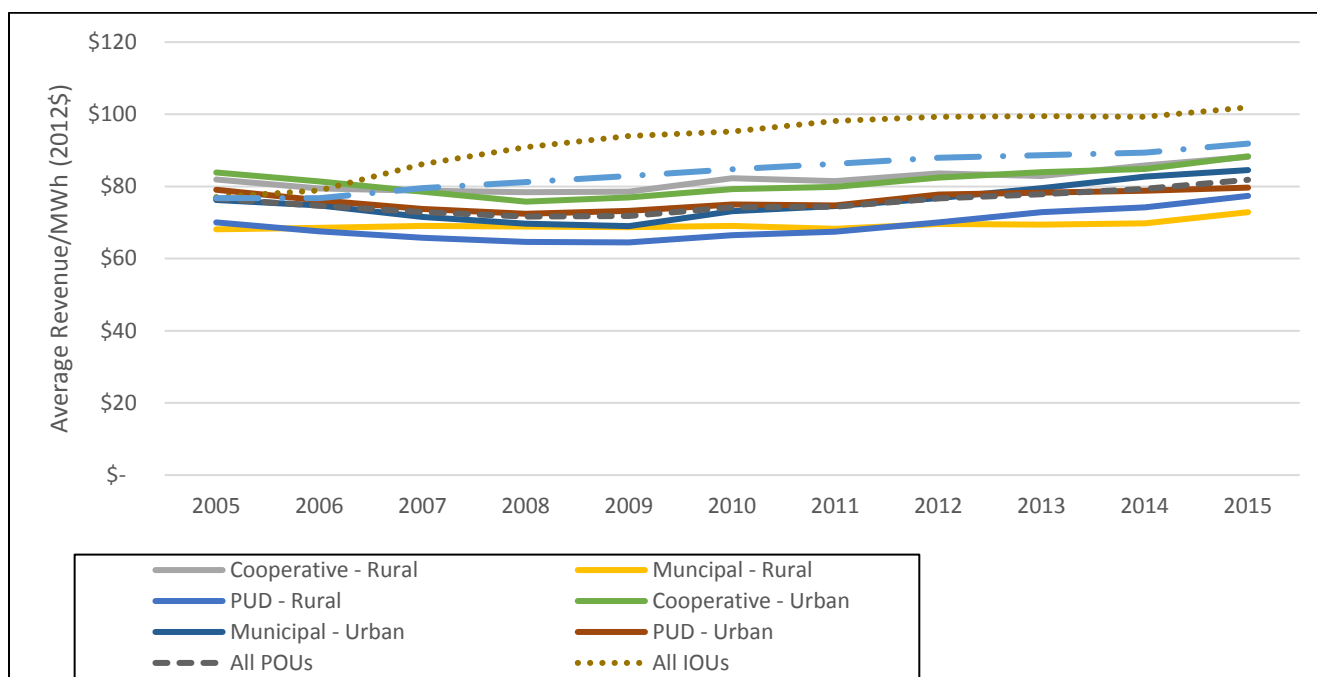
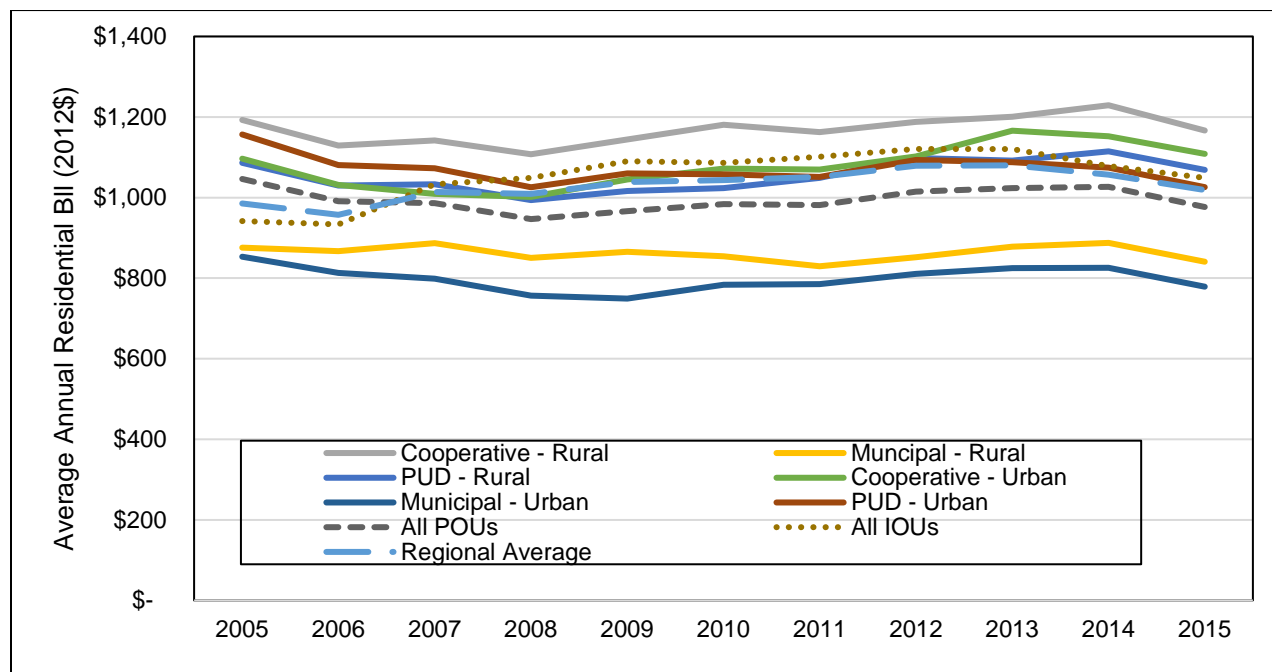


Figure 10 shows the trend in average annual residential electricity bills from 2005 through 2015 by utility ownership type and service area characteristic (i.e., urban vs. rural) after normalizing for weather and adjusting for inflation. The trends in average annual residential electricity bills differs across utility ownership and service area types reflect the underlying trends in average annual use and average annual revenue collected per megawatt-hour. For example, between 2005 and 2015 the bill for the average residential customer of investor-owned utilities increased from approximately \$940 per year to \$1,050 per year adjusted for inflation, an increase of around \$110. This increase occurred even though the average use per residential customer of investor-owned utilities declined by about 19 percent, because the average revenue collected per megawatt-hour of sales increase by 32 percent. In contrast, the customers of municipal utilities serving urban areas saw a drop in their average annual electricity bill, despite the fact that these utilities average revenue collected per megawatt-hour increased by around 10 percent, due to the decrease in their average annual use per residential customer.

Figure 10 – Average Residential Electricity Bill by Utility Ownership and Service Area Characteristic 2005 – 2015 (Weather Normalized and Adjusted for Inflation)



From the preceding discussion it is clear that the average residential electric bill varies widely across the region and is more dependent on the characteristics of the “average” residential consumer served by a utility, than whether the utility is a public or privately owned utility. Figure 11 shows the frequency distribution of average annual residential electricity bills of publicly owned and investor owned utilities in 2015. From this figure it can be observed that the bulk of residential customers in the region spend between \$900 and \$1500 per year for electricity.

Figure 11 - Frequency Distribution of Residential Electricity Bills for Publicly Owned and Investor Owned Utilities in 2014 (Nominal\$, Not Weather Normalized)

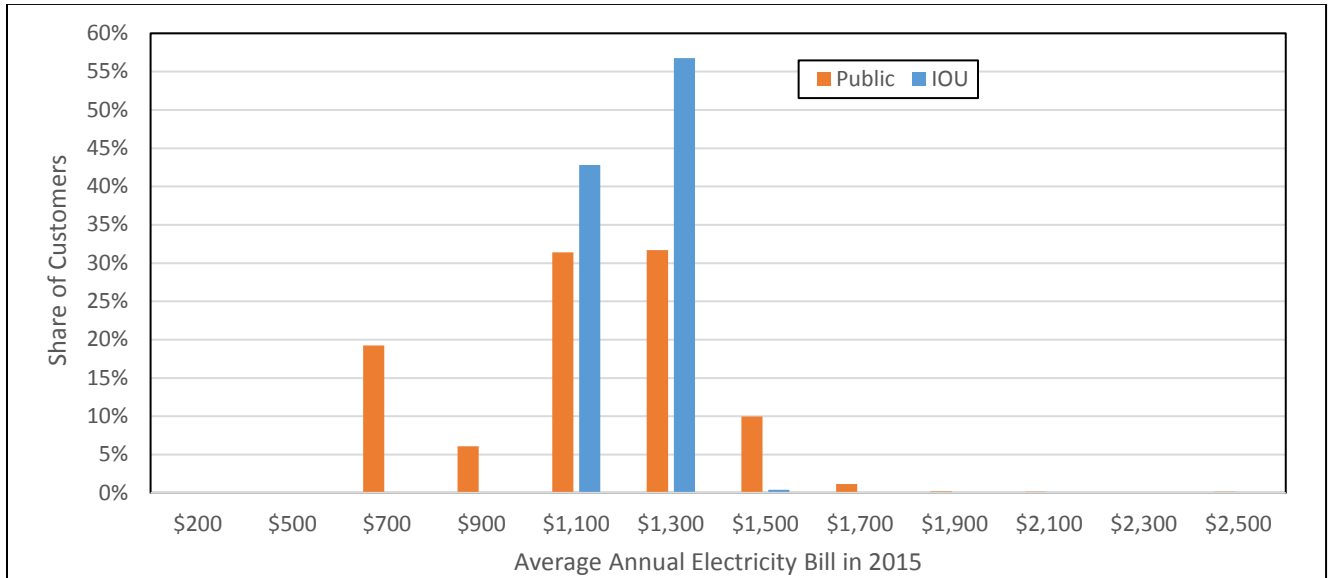
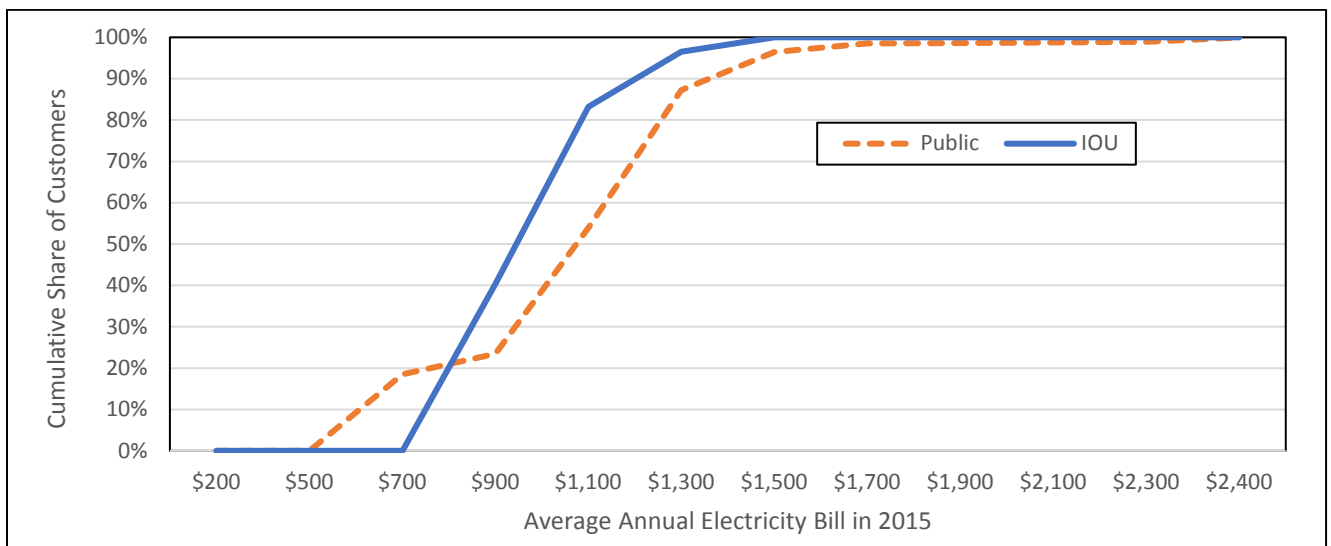


Figure 12 shows the cumulative frequency distribution of average annual electricity bills for residential customers of 133 utilities in the region. This figure shows that the average annual electricity bill for nearly 90 percent of customers of publicly owned utilities is less than \$1300. Figure 12 also shows that the average annual electricity bill for around 95 percent of customers of investor owned utilities is less than \$1300.

Figure 12 – Cumulative Frequency Distribution of Residential Electricity Bills for Publicly Owned and Investor Owned Utilities in 2015 (Nominal\$)



Sources of Variations in Average Residential Electricity Bills

This section of this report explores the potential reasons for the variation in annual average electricity use, the variation in average annual electricity cost per megawatt-hour and the resultant average annual bill across utilities.

Table 1 shows the two variables that determine a residential consumers electric bills – price per unit of electricity (i.e., retail rates) and the amount of electricity consumed (i.e., electricity use) for the various types of utility ownerships and service area characteristics. Either higher rates or higher consumption, or a combination of the two can be the root cause of higher average bills.

Table 1 shows the average of annual consumption and average electric revenue per megawatt-hour for residential customers for the 2005-2015 period across utility ownership types and service territory composition. The average household in the region consumed about 12.1 MWH per year over the past 11 years. Residential customers of publically owned utilities consumed about 8% more electricity per year than the regional average or 13.1 MWH per year. The average residential customers of IOUs used about 11.5 MWH of electricity per year or about 6% below regional average. The average residential electricity use per customer in publicly owned utilities for this period was 15% above the investor owned utilities.

Table 1- Annual Average of Electricity Use, Rates and Bills by Utility Ownership and Service Area Type 2005-2015 (Bills adjusted for inflation, Weather Normalized Consumption)

Utility Type	Annual Average Use (adjusted for Weather) (MWH/year)	Average Revenue Collected per MWH ²	Average Electric Bill (2012\$ /Customer /year)	Difference in Average Electricity Use from Regional Average Use (MWh/year)
Publics				
Rural - Cooperative	14.4	\$ 79	\$ 1,190	2.3
Rural - Municipals	12.5	\$ 67	\$ 872	0.3
Rural – PUDs	15.3	\$ 67	\$ 1,067	3.2
Urban - Cooperatives	13.2	\$ 79	\$ 1,090	1.1
Urban - Municipals	10.6	\$ 73	\$ 807	-1.5
Urban – PUDs	14.1	\$ 74	\$ 1,083	1.9
All Publics	13.1	\$ 73	\$ 1,006	1.0
IOUS (All Urban)	11.4	\$ 90	\$ 1,067	-0.7
Regional Average	12.1	\$ 82	\$ 1,037	0.0

As can also be seen from Table 1 there is significant variation in the average annual use per residential customer across public utilities. This variation is largest between those serving urban areas and those serving rural areas. Residential customers of publically owned, municipal utilities serving urban areas have the lowest residential consumptions per year while investor-owned utilities have the second lowest annual use per customer of all utility types. For example, for cooperatives and PUDs serving rural areas the average use per residential customer were 2.3 and 3.2 MWh/year above the regional average annual use. In contrast the average annual use of residential customers of IOUs and municipal utilities serving urban areas is 0.7 to 1.5 MWh/year lower than the regional average use per residential customer.

Table 1 also shows the average revenue per megawatt-hour of retail sales for the residential sector over the period from 2005 through 2015. As can be seen, the average revenue collected per megawatt hour of retail sales is lower than the regional average for all public utilities and higher than the regional average for investor owned utilities. Across all public utilities the average revenue collected per megawatt hour of retail sales is 11% below the regional average while for investor owned utilities it is about 10% above the regional average.

² The “average revenue per megawatt-hour should not be viewed as the retail rate per megawatt-hour paid by customers. Since it is calculated by dividing total annual revenues by total annual retail sales it includes all customer charges, including monthly fixed charges, demand charges, and charges per unit of electricity consumed.

An inspection of the data shown in Table 1 reveals the need to consider both annual use and retail electricity cost per megawatt-hour when comparing the total annual cost of electricity service across utilities. That is, without knowing both the average annual electricity use and the average cost per megawatt-hour of consumption, it is not possible to determine whether the average annual total cost of electricity for customers served by one utility is lower or higher than customers served by another utility.

This is best illustrated by comparing the customer bills of cooperatives serving urban areas with those of PUDs serving rural areas. PUDs serving rural areas collected an average of \$67 in revenues per megawatt-hour of retail sales while cooperatives serving urban areas collected \$79 in revenues per megawatt-hour of retail sales, or nearly 18 percent more than PUD serving rural areas. However, the annual electricity bills of these two groups differs by less \$23 annually (\$1,067 vs. \$1,090 per year).

Table 2 shows the average annual residential electricity bill as well as the lowest and highest bills paid by residential customers by utility type for just the year 2015.³ From Table 2 it can be seen that on average residential customers in the region paid about \$1,177 dollars for electricity in 2015. The lowest observed average annual residential electricity bills were for customers of a municipal utility with a rural service area. The residential customers of that utility paid, on average, \$123 dollars per year for their electricity. The highest average annual electricity bill was paid by the residential customers of a cooperative serving a rural area. This utility's average residential customer paid \$2,404 dollars per year for electricity.

Table 2 - Variance in Average Residential Electricity Bills in 2015

(Nominal\$, Not Weather Normalized)

	Lowest Annual Electricity Bill/Residential Customer	Average Annual Electricity Bill/Residential Customer	Highest Annual Electricity Bill/Residential Customer	Difference in Average Electricity Bill from Regional Average Bill
Public Utilities				
Rural - Cooperatives	\$ 457	\$ 1,303	\$ 2,404	\$ 126
Rural – Municipals	\$ 123	\$ 1,034	\$ 2,363	\$ (143)
Rural - PUDs	\$ 768	\$ 1,174	\$ 1,996	\$ (2)
Urban - Cooperatives	\$ 912	\$ 1,156	\$ 1,396	\$ (20)
Urban - Municipals	\$ 695	\$ 922	\$ 1,215	\$ (254)
Urban - PUDs	\$ 647	\$ 1,093	\$ 1,252	\$ (83)
Public Utilities (All)	\$ 123	\$ 1,178	\$ 2,404	\$ 1
Investor Owned Utilities	\$ 969	1,181	\$ 1,667	\$ 5
Regional Average		\$ 1,177		

³ Data in Table 2 are not weather normalized nor have the bills for this year been adjusted for inflation. It should be noted that minimum and maximum bills vary by year.

It should be noted that this report has not investigated the reason/s behind the lowest and highest annual bills. These bills may represent cases with very low or high seasonal consumption.

Table 2 mask the underlying relationship between the magnitude of a customer's annual average electricity bill and both their level of consumption and "average revenue" per unit of consumption. Table 4 shows not only the average annual bill for the utilities with the highest and lowest bills, but also the average annual electricity consumption per customer and the average revenue collected per megawatt-hour of residential sector retail electricity sales.

Table 3 shows that the average annual consumption of customers of the municipal utility with the lowest annual electricity bill was only 2 megawatt-hour per year. In contrast, the residential customers of the cooperative with the highest annual average electricity bills consumed 29 megawatt-hour per year – over 14 times the average use of consumers with the lowest annual bills. This extreme variation in annual electricity consumption overwhelms the fact that the average revenue per megawatt-hour of use paid by customers of the utility that has the lowest average annual bills is 24% higher than the average revenue per megawatt-hour paid by the customers that have the highest average annual electricity bill (\$67 vs. \$83).

Table 3 – Range of Electric Bills, Consumption and Average Revenue per MWh in 2015⁴
(Nominal\$, Not Weather Normalized)

Utility Ownership and Service Area	Rural - Lowest	Rural - Highest		Urban - Lowest	Urban – Highest
Cooperative					
Electric Bill \$/year/customer	\$457	\$ 2,404		\$ 912	\$1,396
Consumption MWH/Customer	3	29		10	14
Calculated Average Revenue per MWh	\$ 138	\$83		\$87	\$97
Municipal					
Electric Bill \$/year/customer	\$123	\$2,363		\$695	\$1215
Consumption MWH/Customer	2	38		8	15
Calculated Average Revenue per MWh	\$67	\$63		\$91	\$83
PUDs					
Electric Bill \$/year/customer	\$768	\$1,996		\$647	\$1,252
Consumption MWH/Customer	11	26		11	21
Calculated Average Revenue per MWh	\$72	\$77		\$58	\$59
Investor Owned*					
Electric Bill \$/year/customer				\$969	\$1,667
Consumption MWH/Customer				8	19
Calculated Average Revenue per MWh				\$118	\$90

⁴ Service area of IOUs were all classified as “urban” even though some serve urban and rural areas on the assumption that the majority of their customers are in urban areas. For utilities that serve multiple states, each state’s service area was considered separately, since their rates and customer characteristics may vary by state. Thus, for example, Idaho Power’s Idaho and Oregon’s service areas were treated as two different “IOUs” even though both are served by the same utility in order to reflect different regulatory commission policies and cost structures.

The preceding discussion clearly illustrates the need to consider both annual consumption and the cost per unit of electricity (i.e., rates) when assessing the affordability of electric service. The remainder of this paper attempts to identify some of the reasons why the average annual residential electricity use varies so significantly across utilities. Table 4 shows the factors we investigated and whether or not we find them contributing to difference in the difference between IOU and POU consumption levels. Of the six factors evaluated, we found access to natural gas and historical energy efficiency contributed to difference in consumption levels.

It should be noted that access to natural gas and urban vs rural designation are almost synonymous.

The other four factors, heating system efficiency, vintage of homes, housing type mix and household income and level of poverty seem to be very similar in IOU and POU service area.

Table 4 – Factors Affecting Average Annual Residential Electricity Bills

Factor	Yes	No
Access to natural gas	X	
Historical energy efficiency	X	
Heating system efficiency		X
Vintage (i.e., age) of homes		X
Housing type mix (i.e., share of single family, multifamily and manufactured homes)		X
Household Income and Level of Poverty		X

Access to Natural Gas

Access to natural gas is not uniform across the urban and rural area or across Investor Owned utilities and Public utilities. The following map shows the overlap of the natural gas and electric utilities in the Northwest. Vast areas in the rural Northwest do not have access to natural gas. To estimate numbers of customers with access to natural gas, a mapping of the electric utilities and the gas utilities that serve these electric utility customers was prepared. This process is not exact and subject to error in assigning natural gas service areas to electric utility service area.

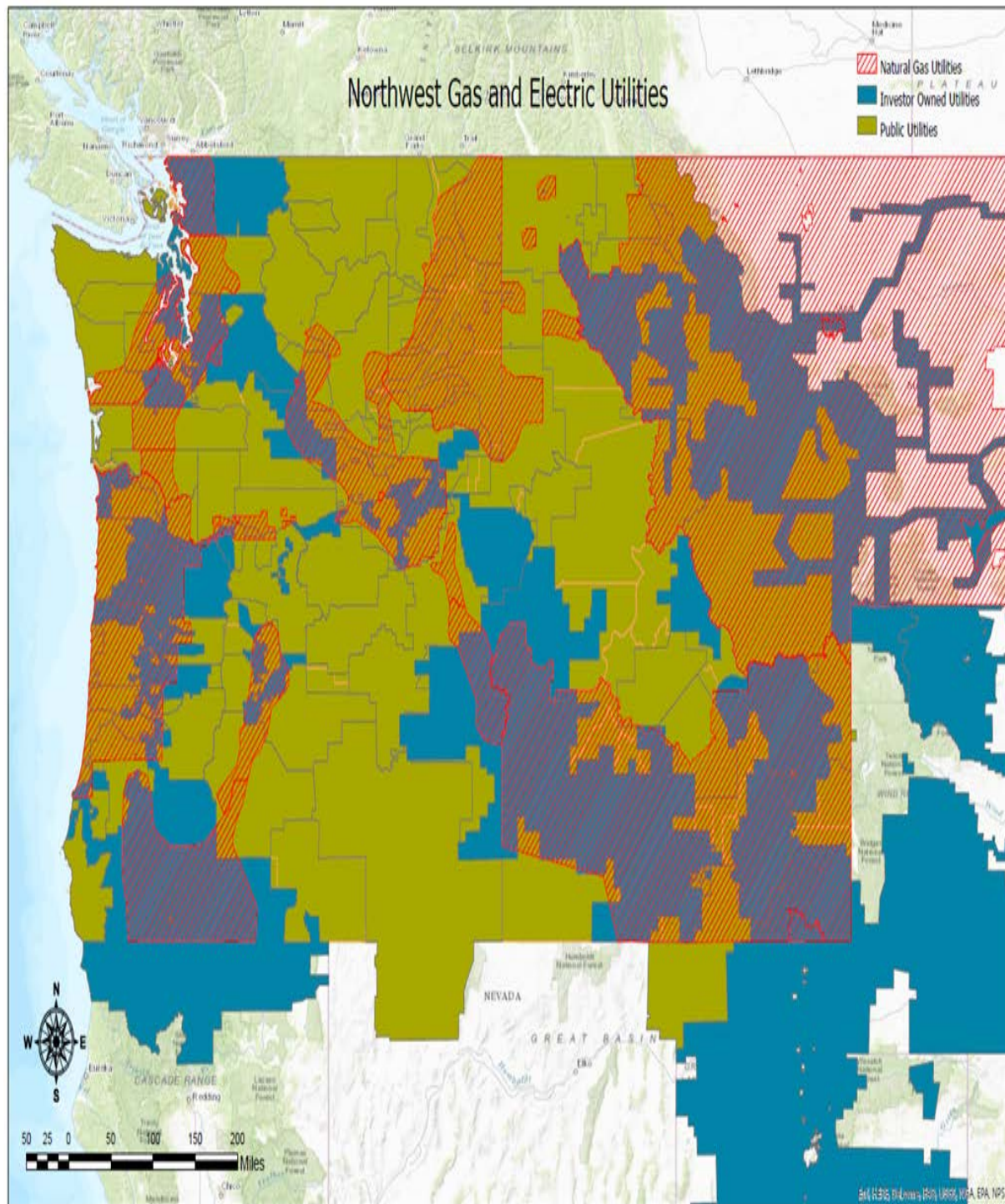
As of 2015 there were about 5.5 million electric utility residential customers. Of this total roughly 68% could access natural gas through their local natural gas distribution utility. Among the IOU customers, 3.2 million customers, roughly 71% had access to natural gas. In the public utilities service areas, of the 2.2 million customers 65% had access to natural gas.

This finding is consistent with the notion that access to natural gas is not available equally across the region.

Table 5 – Access to natural Gas across the NW*

	Number of Electric Utility Residential Customers	% Customer with access to natural gas in Rural Area	% Customer with access to natural gas in Urban Area	Number of households with access to Natural Gas	Number of Households without access to Natural Gas
Coops	488,000	56%	21%	76%	24%
Muni's	787,000	9%	88%	98%	2%
PUDs	982,000	12%	20%	32%	68%
All Publics	2,257,000	21%	44%	65%	35%
IOUs	3,210,893			71%	29%
Total	5,467,893			68%	32%

- Values shown should be considered as estimates at best.



Underlying Causes of Differences in the Average Use per Residential Customer

Five building stock and equipment factors as well as two socio-economic factors were investigated to determine their influence on the differences observed in the average annual electricity consumption across utilities and the changes in average annual use over time. The five building and equipment related factors were:

- Saturation of electric space and water heating
- Saturation of electric space heating technologies
- Differences in housing stock mix (e.g. share of single family, multi-family and manufactured housing)
- Housing stock vintage
- Energy efficiency investments

The findings regarding each of these factors are discussed below.

Finding – The average annual electricity use per residential customer served by public utilities is higher because they have a higher saturation of electric space and water heating than those served by investor owned utilities

Space and water heating are two of the largest energy consuming end-uses in a typical household. Therefore, differences in the energy form used for these end uses could contribute to the differences observed in average annual use of electricity across utilities. Table 6 below shows the data derived from the Residential Building Stock Assessment (RBSA) on the heating system fuel types for investor-owned and publicly owned utilities. Table 6 shows that 43% of households served by public utilities are heated with electricity compared to only 22% of the households served IOUs. In contrast, in IOUs service areas 53% of households heat with natural gas while only 32% of the households served by public utilities used natural gas for space heating.

Table 6 – Space Heating Fuel Market Share by Utility Type

Fuel Type	IOU	Publics	Region
Electric	22%	43%	30%
Natural Gas	53%	32%	45%
All others	25%	26%	25%

Table 7 below shows the data derived from the RBSA on the water heating system fuel types for investor owned and publicly owned utilities. Table 7 shows that 67% of households served by public utilities heat water with electricity compared to only 52% of the households served investor owned utilities. In contrast, 46% of households in investor owned utility service areas heat water with natural gas while 31% of the households served by public utilities use natural gas for water heating.

Table 7 – Water Heating Fuel Market Share by Utility Type

Fuel Type	IOU	Public	Region
Electric	52%	67%	59%
Natural Gas/propane	46%	31%	40%
All others	2%	2%	1%

Finding – The higher average annual electricity use of residential customer served by public utilities compared to those served by investor owned utilities is not due to differences in the mix of electric space heating technologies.⁵

Some electric space heating technologies are significantly more efficient than others. In particular electric heat pumps generally use less electricity to heat than do electric force-air furnaces. Homes that use electric baseboard also tend to use less electricity for space heating than do homes with electric forced-air furnaces because these systems do not have duct losses and enable consumers to set the temperature in some rooms lower than in others (i.e. “zone” their homes). Table 8 shows the RBSA data on electric space heating technology market shares by utility ownership type. From this table it can be observed that two electric space heating technologies, heat pumps and baseboard or zonal systems, are the most common systems used in both investor owned and publicly owned utility service areas. Publicly owned utilities have a higher share of heat pumps while investor owned utilities have a greater share of electric baseboard or zonal heating systems in their respective service areas. The higher market share of electric baseboard or zonal systems in investor owned utility service areas is likely due to the fact that these utilities serve largely urban areas where there are more multifamily dwellings where such systems dominate.

Since homes with heat pumps also use electricity for air conditioning and tend to be larger in size than those using electric baseboard or other zonal electric heating systems their annual use is similar. Therefore, it does not appear that the difference in the market share of specific electric space heating technologies between customers of publicly owned and investor owned utilities is a significant factor in the differences in average annual electricity consumption between these two groups.

Table 8 – Electric Space Heating Technology Market Shares by Utility Type

Electric Heating System Technology	Marker Share of Electric Heat		
	IOU	Public	Region
Ductless HP	3%	2%	3%
Electric Baseboard/Zonal	47%	38%	42%
FAF/electric	19%	19%	19%
Heat Pump	31%	40%	36%
Total Electric	100%	100%	100%

⁵ This study’s focus is limited to annual electricity bills. The total energy bill for households with access to natural gas may that use that fuel for space and water heating will is, therefore, not reflected in the “bill” comparisons reported in this paper.

Finding – The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities is not due to differences in the composition of housing stock in their service areas.

Due to differences in size, heating system mix and overall building shell efficiency the mix of single family, multifamily and manufactured (i.e. mobile) homes could have a potential impact on the average energy use observed for customers of publicly owned and investor owned utilities. However, as is shown in Table 9 the market share of each of these housing types does not differ significantly between publicly owned and investor owned utility service areas. Across both types of utilities, about three-quarters of the residential building stock are in single family homes, roughly 16-17 percent are multifamily dwellings and around ten percent are manufactured homes.

Publicly owned utilities have a slightly larger percent of multi-family units. While this housing type is more likely to heat with electricity these dwelling units are also smaller and have fewer occupants so typically use less electricity than either single family or manufactured homes. All else equal this reduces the difference in average use per residential customer between publicly owned and investor owned utility service areas by lowering the average use per customer.

Table 9 - Market Share of Residential Units by Dwelling Type

	IOU	POU	Total
Single Family	77%	74%	76%
Multi family	13%	16%	14%
Manufactured Housing			
Multi-section	7%	7%	7%
Single section	3%	3%	3%

Finding - The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities is not due to differences in the vintage of housing stock in their service areas.

Table 10 provides the RBSA data on the mix of vintages (i.e., year of construction) of residential dwellings in publicly owned and investor owned utility service areas. Across the four vintage categories reported there are only slight differences in market share. Therefore, it does not appear that differences in the average age of the residential building stock contributes to the observed differences in average annual publicly owned and investor owned utility customer electricity use.

Table 10 - Housing Stock Market Share by Vintage*

	Pre 1980	1980-1992	1993-2006	Post 2006
Single Family -IOUs	62%	17%	16%	5%
Single Family - POU	65%	15%	14%	5%
Manufactured Housing -IOU	35%	32%	27%	3%
Manufactured Housing -POU	35%	34%	27%	3%

*- similar information for multi-family units was not available.

Finding – The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities is not due to differences in historical levels of investment in energy efficiency. However, there appears to be a strong positive correlation between the long-term trends in average annual electricity use per residential customer and the level of conservation acquired by utilities.

The impact of investment in conservation accumulate over time. For example, investments made in the past to increase the thermal efficiency of homes continue to impact today's energy consumption. Thus, in order to assess the impact of conservation investments on the residential sector's electricity consumption, historical data on such investments is needed.

As shown in Table 11, based on the reported conservation achievements for the decade covering 2005 through 2015 total residential retail sales have been reduced by just over 970 average megawatts from utility residential sector programs, including low income programs and NEEA programs. Conservation acquired from 2005 through 2015 reduced investor owned utility 2015 retail sales by about 550 aMW or 1,508 kWh per year per customer in 2015. Conservation acquired from 2005 through 2015 reduced publicly owned utility 2015 retails sales by around 417 aMW or 1585 kWh per year per customer in 2015. It should be noted that IOU conservation acquisition levels per customer is lower due to larger count of residential customers, 3.2 million compared to 2.2 million residential customers.

Table 11 – Annual and Cumulative Residential Conservation Acquisitions 2005-2015, Including NEEA and Low Income Weatherization

(Average Megawatts at Customer Site⁶)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2005-2015
IOU	38	31	42	57	59	38	56	58	56	64	53	552
POU	17	21	33	35	62	47	55	34	36	42	35	417

It appears that customers of those utilities serving rural service areas acquired a lower share of energy efficiency savings than either their regional share of customers or retail sales. Table 12 shows that about seven percent of the regional conservation resource acquisition

⁶ Savings reported in this table do not include line losses. Residential sector savings including line losses (i.e., equivalent to generation offset for this period are 1,042 aMW)

that occurred between 2005 and 2015 was accomplished in publicly owned utilities serving rural areas. These utilities serve about 14 percent of the region's residential customers and represent about 17 percent of regional residential sales. In contrast, publicly owned utilities serving urban areas produced 36 percent of the regional residential savings while representing 27 percent of the region's customers and 28 percent of the region's residential load. The region's investor owned utilities serve about 58 percent of the region's residential customers and 55 percent of regional residential sales. Collectively, these utilities acquired about 57 percent of the residential sector savings between 2005 and 2015.

Table 12 - Market Share of Residential Customer Counts, Sales, and Conservation Acquisitions by Utility Ownership and Service Area Characteristics

	Share of Residential Customers	Share of Residential Sector Retail Sales	Share of Regional Conservation Acquisitions	Average Annual Growth Rate in Electricity Use per Customer ⁷
Rural	14%	17%	7%	
Cooperative	7%	9%	3%	-0.20%
Municipal	2%	2%	1%	-0.32%
PUDs	5%	7%	3%	-0.40%
Urban	27%	28%	36%	
Cooperative	2%	2%	3%	0.34%
Municipal	13%	11%	16%	-1.17%
PUDs	13%	15%	17%	-0.52%
All Publics	42%	45%	43%	-0.35%
Investor Owned	58%	55%	57%	-0.96%
Regional Average	100%	100%	100%	-0.77%

Table 12 shows the average annual rate of growth (or decline) between 2005 and 2015 in the average annual electricity use per customer by utility ownership type and service area characteristic. From Table 12 it can be observed that for those utilities which acquired significantly less conservation than they represent as a share of regional retail sales, experienced smaller decrease in the average use per customer over the period between 2005 and 2015 than those utilities whose share of regional conservation acquisition corresponded more closely with their share of regional retail sales.

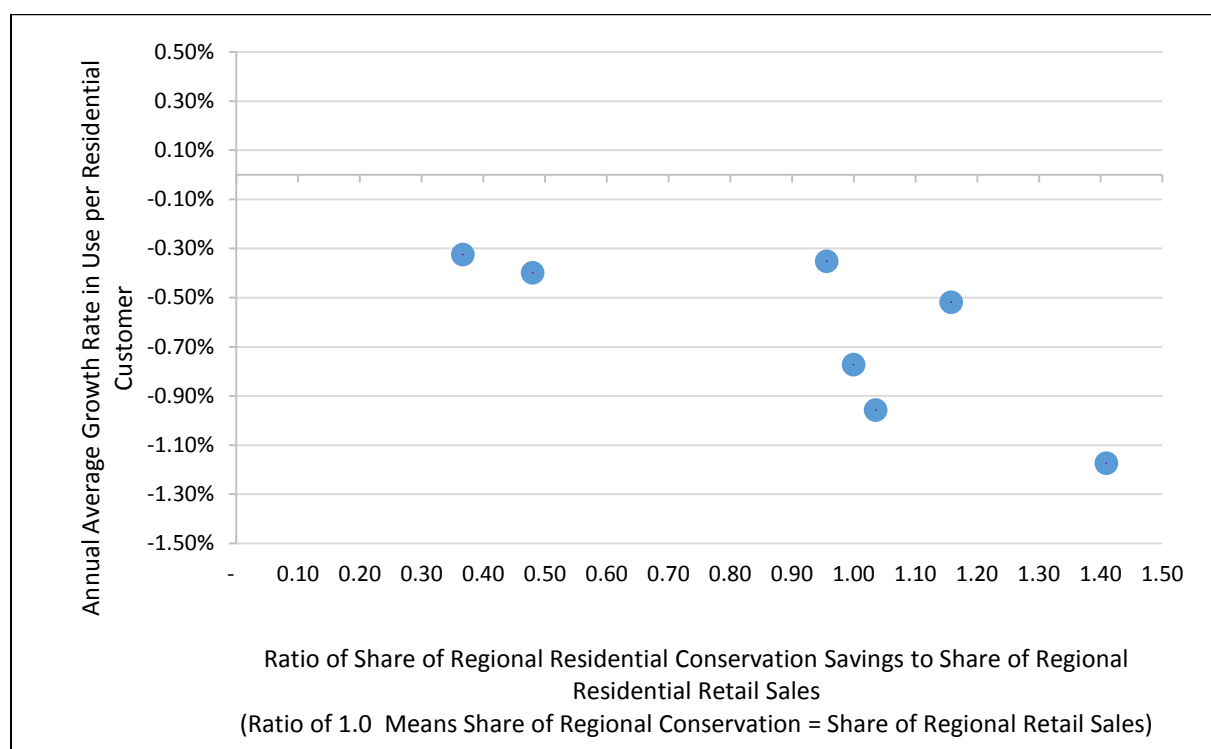
For example, cooperatives serving urban service areas acquired around 3 percent of the regional residential conservation savings between 2005 and 2015, these utilities represented 2 percent of regional retail sales. The average annual electricity use per residential customers served by these utilities grew by 0.34% per year between 2005 and 2015. In comparison, municipal utilities serving urban areas acquired 16 percent of the residential sector conservation between 2005 and 2015, but represent only 11 percent of the region's residential retail sales. The average annual electricity use per residential customers of these utilities declined by 1.17% per year between 2005 and 2015. Similarly, the region's investor owned utilities represent about 55% of regional retail sales, but acquired 57% of the regional

⁷ The average annual growth in average customer use does not mean that all individual utilities in these categories experience positive (or negative) growth in residential use per customer, nor should it be assumed that share of conservation achieved by individual utilities was similar to the group average share.

residential conservation between 2005 and 2015. Over this period, the average retail sales per customer of the investor owned utilities declined by almost 1% per year.

There appears to be a correlation between the degree to which a utility's share of regional conservation aligns with either its regional share of residential customers or its regional share of retail sales and the average annual rate of change in the average electricity use per customer. Figure 13 plots the relationship between the average annual rate of growth in average annual use per residential customer and a measure of how closely the share of utility energy efficiency savings correspond to their share of regional retail electricity sales. An inspection of Figure 13 shows that those utilities with the lower growth rates in electricity use per customer between 2005 and 2015 also had shares of the regional residential energy efficiency savings that were near or above their share of regional residential electricity sales.

Figure 13 – Relationship between Growth in Annual Average Residential Electricity Use per Customer and Energy Efficiency Savings



The relationship between conservation acquisitions and changes in the average annual electricity use per customer from 2005 to 2015 appears to have a significant impact on the direction and magnitude of the change in average annual customer bills. Table 13 shows the difference in average annual bills by utility ownership type and service area characteristic between 2005 and 2015. Differences are shown in both nominal and real (inflation adjusted) dollars.

A comparison of Table 12 with Table 13 reveals that among the public utilities the greatest increases in average annual residential electricity bills between 2005 and 2015 occurred among those utilities that also had the largest growth rates in average annual electricity use per residential customer. Moreover, as was noted above, these are the same public utilities that acquired significantly less residential conservation than either their regional share of

retail sales or customers. In contrast, the average annual electricity bills of those public utilities that acquired a larger share of the region's residential conservation than their share of either retail sales or customers saw the smallest increases in annual average bills or actual declines in annual average in real, inflation adjusted terms, between 2005 and 2014.

The decline in average annual electricity use per customers (i.e., negative growth/customer), served by investor owned utilities kept their customer bill increase to \$182 between 2005 and 2015. That is, the 16% reduction in average annual electricity use over that past 11 years partially offset the fact that the average revenue collected per megawatt-hour for these utilities increased from \$77 to \$102 per year.

Table 13 – Difference in Average Annual Residential Electricity Bills 2005 - 2015

Utility Ownership and Service Area Type	Nominal dollars not adjusted for Inflation of weather	Real (2012\$) Weather Normalized
Rural		
Cooperatives	\$ 257	\$ 64
Municipals	\$ 170	\$ 30
PUDs	\$ 239	\$ 64
Urban		
Cooperative	\$ 272	\$ 95
Municipals	\$ 122	\$ (12)
PUDs	\$ 133	\$ (48)
All POUs	\$ 173	\$ 7
All IOUs	\$ 339	\$ 182
Regional Average	\$ 270	\$ 94

Finding 6 – The higher average electricity use residential customer served by public utilities compared to those served by investor owned utilities or those serving urban and rural area does not appear to be related to differences in income.

To conclusively demonstrate whether differences in income are related to the observed differences in average annual electricity use observed between investor owned utilities and among the various types of publicly owned utilities' residential customers, utility specific demographic data on both income and electricity consumption is required. NEEA, through its 2016 Residential Building Stock Assessment is collecting this data. However, until this data is available it is only possible to determine whether there are differences in average income levels between investor owned and the major types of publicly owned utilities.

The average income by utility type was calculated using estimated median income by zip code produced by US Census, available from American Community Surveys for 2014 (ACS2014). The data from ACS2014 and the Energy Information Administration's Form 861 reports (EIA861) and a data set available from National Renewable Energy Laboratory

(NREL) which associates each utility with zip codes, was then used to produce a rough estimate of each utility's average customer's income level.

Table 14 shows the median income per household and number of households by utility type. The average regional income is about \$50,000 dollars. The median income is 13% higher for investor owned customers than it is for publicly owned utilities. In the publicly owned utility service areas, average income is about \$47,000 dollars compared to about \$53,000 dollars in investor owned utility service areas. However, the customers in the urban areas served by public utilities have the highest income level.

Table 14 - Median Income and Number of Households by Utility Type

Ownership and Area	Median Income	Number of Households
Cooperative	45,310	529,695
Rural	44,728	462,909
Urban	55,528	66,786
Municipal	59,463	457,940
Rural	46,202	36,743
Urban	60,897	421,197
PUDs	46,797	540,042
Rural	43,661	185,082
Urban	51,024	354,960
All Public Utilities	50,523	1,527,677
Investor Owned	53,183	3,180,731
Other ⁸	NA	207,588
Grand Total	49,999	4,915,996

Data from ACS2014 was also used to estimate total population and population below the federal poverty threshold for the entire region. This data appears in Table 15. The annual poverty threshold varies by size of the family. In 2014, annual income threshold for a single individual to be consider below the poverty level was between \$11,000 to \$12,000 dollars. For a family of three the income threshold is about \$19,000. The threshold for a family of 8 or more is about \$49,000 dollars. Table provided in the appendix shows further details on income threshold levels.

The ACS2014 estimates total population and the share of population below poverty level for various geographic levels. The estimated count of population and count of people below poverty at zip code level was used to determine whether there is a difference between poverty levels in investor owned and publicly owned service areas. Utilities service areas were mapped to zip codes, then poverty data at the zip code level were used to estimate level of poverty level by utility.

The results of this analysis are also shown in Table 15. In 2014 there were about 1.8 million people or roughly 15% of regional population in poverty at regional level (Idaho, Oregon, Washington, and Western Montana). Two-thirds of this population is in investor owned utility service areas and one-third is in areas served by publicly owned utilities. While the share of people at or below the poverty level is higher in areas served by public utilities than it is

⁸ Other includes households in zip codes area served by multiple utilities.

areas served by investor owned utilities (16% vs. 14%), the absolute number of people with incomes at or below the poverty level is nearly double in areas served by investor owned utilities than in areas served by publicly owned utilities.

Table 15 - Population and People in Poverty by Utility Ownership Type⁹

Utility Ownership	Population	People in poverty	Share in Poverty
IOU	8,248,525	1,165,451	14%
Public	3,817,408	621,408	16%
Other	485,016	72,496	15%
Grand Total	12,550,949	1,859,355	15%

⁹ Data in Table 16 represents the region as defined by the Northwest Power and Conservation Act, and therefore excludes Eastern Montana.

Appendices

Table A-1: Housing Stock Characteristics – Dwelling Type¹⁰

Building Type		Utility Type		URBAN_RURAL		Total
		IOU	POU	Rural	Urban	
MFG HOME	Count	311,793	231,936	216,613	327,116	543,728
	Percent of Total	5.86	4.36	4.07	6.14	10.21
	Row Pct	57.34	42.66	39.84	60.16	
	Col Pct	9.88	10.7	17.77	7.97	
Multi-Family	Count	417,794	338,979	85,051	671,722	756,773
	Percent of Total	7.85	6.37	1.6	12.62	14.21
	Row Pct	55.21	44.79	11.24	88.76	
	Col Pct	13.23	15.64	6.98	16.36	
Single Family	Count	2,427,336	1,596,594	917,088	3,106,842	4,023,930
	Percent of Total	45.59	29.99	17.22	58.35	75.57
	Row Pct	60.32	39.68	22.79	77.21	
	Col Pct	76.89	73.66	75.25	75.67	
Total	Count	3,156,923	2,167,509	1,218,751	4,105,680	5,324,431
	Col Pct	59.29	40.71	22.89	77.11	100
Building Type		Utility Type		URBAN_RURAL		Total
		IOU	NWP	Rural	Urban	
MFG HOME	Count	311,793	231,936	216,613	327,116	543,728
Multi-Family	Count	417,794	338,979	85,051	671,722	756,773
Single Family	Count	2,427,336	1,596,594	917,088	3,106,842	4,023,930
Total	Count	3,156,923	2,167,509	1,218,751	4,105,680	5,324,431
	Col Pct	59.29	40.71	22.89	77.11	100

¹⁰ Tables A-1 and A-2 were derived from NEEA's Residential Building Stock Assessment (RBSA). The RBSA's sample frame was designed to be statistically representative at the regional level. The parsing the results by utility ownership and service area characteristics (i.e., urban vs. rural) does not have the same level of statistical reliability or representation as the survey's regional results.

Table A-2: Housing Stock Characteristics – Detailed Building Types

Detailed Building Type		Utility Type		URBAN_RURAL		Total
		IOU	POU	Rural	Urban	
Double Wide	Frequency	189,535	132,896	127,663	194,768	322,431
	Percent of Total	3.56	2.5	2.4	3.66	6.06
	Row Pct	58.78	41.22	39.59	60.41	
	Col Pct	6	6.13	10.47	4.74	
Duplex, Triplex, or Fourplex	Frequency	140,168	36,388	41,908	134,648	176,556
	Percent of Total	2.63	0.68	0.79	2.53	3.32
	Row Pct	79.39	20.61	23.74	76.26	
	Col Pct	4.44	1.68	3.44	3.28	
Flats/Apartments	Frequency	397,900	315,914	85,051	628,763	713,814
	Percent of Total	7.47	5.93	1.6	11.81	13.41
	Row Pct	55.74	44.26	11.92	88.08	
	Col Pct	12.6	14.57	6.98	15.31	
Modular/Prefab	Frequency	11,605	13,471	18,517	6,558	25,075
	Percent of Total	0.22	0.25	0.35	0.12	0.47
	Row Pct	46.28	53.72	73.85	26.15	
	Col Pct	0.37	0.62	1.52	0.16	
Other	Frequency	0	2,129	2,129	0	2,129
	Percent of Total	0	0.04	0.04	0	0.04
	Row Pct	0	100	100	0	
	Col Pct	0	0.1	0.17	0	
Single Family, Detached	Frequency	2,214,069	1,535,379	843,610	2,905,838	3,749,448
	Percent of Total	41.58	28.84	15.84	54.58	70.42
	Row Pct	59.05	40.95	22.5	77.5	
	Col Pct	70.13	70.84	69.22	70.78	
Single Wide	Frequency	99,609	71,722	57,944	113,387	171,331
	Percent of Total	1.87	1.35	1.09	2.13	3.22
	Row Pct	58.14	41.86	33.82	66.18	
	Col Pct	3.16	3.31	4.75	2.76	
Townhouse or Rowhouse	Frequency	92,993	47,892	31,570	109,315	140,885
	Percent of Total	1.75	0.9	0.59	2.05	2.65
	Row Pct	66.01	33.99	22.41	77.59	
	Col Pct	2.95	2.21	2.59	2.66	
Triple Wide	Frequency	11,044	11,718	10,360	12,402	22,762
	Percent of Total	0.21	0.22	0.19	0.23	0.43
	Row Pct	48.52	51.48	45.51	54.49	
	Col Pct	0.35	0.54	0.85	0.3	
Total		3,156,923	2,167,509	1,218,751	4,105,680	5,324,431
		59.29	40.71	22.89	77.11	100

Table A-3: Poverty Thresholds for 2014 by Size of Family and Number of Related Children Under 18 Years

Size of family unit	Weighted Average Thresholds
One person (unrelated individual).....	12,071
Under 65 years.....	12,316
65 years and over.....	11,354
Two people.....	15,379
Householder under 65 years.....	15,934
Householder 65 years and over.....	14,326
Three people.....	18,850
Four people.....	24,230
Five people.....	28,695
Six people.....	32,473
Seven people.....	36,927
Eight people.....	40,968
Nine people or more.....	49,021
Source: U.S. Census Bureau.	

Table A-4: Median Income and Household Count by Utility Type

Ownership and Area	Median income	Margin of Error	Number of Households
Cooperative	45,310	13,125	529,695
Rural	44,728	13,220	462,909
Urban	55,528	11,459	66,786
Municipal	59,463	6,431	457,940
Rural	46,202	3,308	36,743
Urban	60,897	6,768	421,197
PUDs	46,797	13,531	540,042
Rural	43,661	13,106	185,082
Urban	51,024	14,105	354,960
All Public Utilities	50,523		1,527,677
Investor Owned	53,183	10,061	3,180,731
Other			
Grand Total	49,999	+/-11,747	4,915,996

Table A-5: Income levels by state

	Median income (dollars); Estimate; Households	Median income (dollars); Margin of Error; Households	Sum of Total; Estimate; Households
ID	45,810	11,678	1,254,184
OR	48,719	9,937	1,163,567
WA	58,077	11,271	2,241,125
WMT	37,569	15,921	60,555
#N/A	46,621	16,139	196,565
Grand Total	49,999	11,747	4,915,996

*-cases were state could not be established.

Table A-6: Estimated Total Population, Population in Poverty and percent of population in Poverty- ACS 2014

	Total Population	Margin of Error	Population with Income in the past 12 months below poverty level:	Margin of Error	percent of Population
Idaho	1,568,375	743	244,618	5,923	16%
Montana	981,707	586	150,096	3,959	15%
Oregon	3,823,874	1,167	638,816	9,214	17%
Washington	6,765,200	1,658	916,364	13,006	14%
Total 4 States	13,139,156	4,154	1,949,894	32,102	15%

Listing of the Utilities included in this report and their ownership and urban/rural designation.

Table A-7: Public Utilities by Ownership and Service Territory Characteristic

Rural Co-Ops	State
Riverside Electric Cooperative	ID
Ravalli County Elec Coop, Inc.	WMT
Vigilante Electric Coop, Inc.	WMT
Vigilante Electric Coop, Inc.	ID
Raft River Rural Elec Coop Inc.	ID
West Oregon Electric Coop Inc.	OR
Wasco Electric Coop, Inc.	OR
United Electric Co-op, Inc.	ID
Umatilla Electric Coop Assn	OR
Tanner Electric Coop	WA
Surprise Valley Electrification Corp.	OR
South Side Electric, Inc.	ID
Salmon River Electric Coop Inc.	ID
Parkland Light & Water Company	WA
Orcas Power & Light Coop	WA
Oregon Trail El Cons Coop, Inc.	OR
Okanogan County Elec Coop, Inc.	WA
Ohop Mutual Light Company, Inc.	WA
Northern Lights, Inc.	WA
Alder Mutual Light Co, Inc.	WA
Northern Lights, Inc.	WMT
Northern Lights, Inc.	ID
Nespelem Valley Elec Coop, Inc.	WA
Modern Electric Water Company	WA
Missoula Electric Coop, Inc.	WMT
Missoula Electric Coop, Inc.	ID
Midstate Electric Coop, Inc.	OR
Harney Electric Coop, Inc.	OR
Lower Valley Energy Inc.	ID
Lost River Electric Coop Inc.	ID
Lincoln Electric Coop, Inc.	WMT
Lane Electric Coop Inc.	OR
Lakeview Light & Power	WA
Kootenai Electric Coop Inc.	WA
Kootenai Electric Coop Inc.	ID
Idaho Cnty L&P Coop Assn, Inc.	ID
Hood River Electric Coop	OR
Inland Power & Light Company	WA
Inland Power & Light Company	ID
Glacier Electric Coop, Inc.	WMT
Fall River Rural Elec Coop Inc.	WMT
Fall River Rural Elec Coop Inc.	ID
Farmers Electric Company, Ltd	ID
Elmhurst Mutual Power & Light Co	WA
East End Mutual Elec Co Ltd	ID
Douglas Electric Coop, Inc.	OR

Consumers Power, Inc.	OR
Coos-Curry Electric Coop, Inc.	OR
Columbia Rural Elec Assn, Inc.	WA
Columbia Rural Elec Assn, Inc.	OR
Columbia Power Coop Assn Inc.	OR
Columbia Basin Elec Cooperative, Inc.	OR
Clearwater Power Company	WA
Clearwater Power Company	OR
Clearwater Power Company	ID
Central Electric Coop Inc.	OR
Blachly-Lane County Coop El Assn	OR
Big Bend Electric Coop, Inc.	WA
Benton Rural Electric Assn	WA

Rural Municipals	State
City of Ashland	OR
City of Weiser	ID
City of Troy	WMT
City of Sumas	WA
Town of Steilacoom	WA
City of Soda Springs	ID
Town of Ruston	WA
Rupert City of	ID
City of Plummer	ID
City of Albion	ID
Port Angeles City of	WA
City of Monmouth	OR
City of Milton	WA
City of Milton-Freewater	OR
City of Minidoka	ID
City of McCleary	WA
City of Heyburn	ID
City of Hermiston	OR
City of Declo	ID
City of Forest Grove	OR
City of Ellensburg	WA
Town of Eatonville	WA
City of Drain	OR
City of Coulee Dam	WA
City of Chewelah	WA
City of Cheney	WA
City of Centralia	WA
City of Cascade Locks	OR
Canby Utility Board	OR
City of Burley	ID
City of Bonners Ferry	ID
City of Blaine	WA
City of Bandon	OR

Rural PUDs	State
PUD No 1 of Jefferson County	WA
PUD No 1 of Whatcom County	WA
Columbia River People's Utility District	OR
Emerald People's Utility District	OR
Clatskanie People's Utility District	OR
PUD No 1 of Mason County	WA
Vera Irrigation District #15	WA
PUD No 1 of Skamania Co	WA
PUD No 3 of Mason County	WA
PUD No 1 of Wahkiakum County	WA
PUD No 1 of Asotin County	WA
PUD No 1 of Pend Oreille County	WA
Pacific Public Utility District No 2	WA
PUD No 1 of Okanogan County	WA
Northern Wasco County PUD	OR
PUD No 1 of Lewis County	WA
PUD No 1 of Klickitat County	WA
PUD No 1 of Kittitas County	WA
PUD No 1 of Franklin County	WA
PUD No 1 of Ferry County	WA
PUD No 1 of Douglas County	WA
PUD No 1 of Clallam County	WA
Central Lincoln People's Utility district	OR

Urban Municipal Utilities	State	Urban PUDs	State
Tacoma City of	WA	Tillamook People's Utility District	OR
City of Springfield	OR	Snohomish County PUD No 1	WA
Seattle City of	WA	PUD No 2 of Grant County	WA
City of Richland	WA	PUD No 1 of Grays Harbor County	WA
McMinnville City of	OR	PUD No 1 of Cowlitz County	WA
Idaho Falls City of	ID	PUD No 1 of Clark County	WA
City of Eugene	OR	PUD No 1 of Chelan County	WA
		PUD No 1 of Benton County	WA

Urban Coops	State
Salem Electric	OR
Peninsula Light Company	WA
Flathead Electric Coop Inc	WMT

Table A -8: Investor Owned Utilities

Investor Owned Utilities	
Avista Corp	WA, ID, WMT
Puget Sound Energy	WA
Portland General Electric Company	OR
PacifiCorp	WA, OR, ID
NorthWestern Corporation	WMT
Idaho Power Co	OR, ID

Mapping of Electric and natural Gas Companies

ELEC COMP	GAS COMPANY
Albion Light & Water Plant	Intermountain Gas Co.
Ashland Dept. of Electric Utilities	Avista Corp.
Avista Corp.	Cascade Natural Gas Corp.
Avista Corp.	Clark Fork & Blackfoot, LLC
Avista Corp.	Avista Corp.
Benton Rural Electric Association	Cascade Natural Gas Corp.
Benton Rural Electric Association	Northwest Natural Gas Co.
Big Bend Electric Coop, Inc.	Cascade Natural Gas Corp.
Big Bend Electric Coop, Inc.	Avista Corp.
Blachly-Lane County Coop Electric Association	Northwest Natural Gas Co.
Blaine City Light Dept.	Cascade Natural Gas Corp.
Bonnors Ferry, City of	Avista Corp.
Burley Municipal Distribution System	Intermountain Gas Co.
Canby Electric Board	Northwest Natural Gas Co.
Cascade Locks Light Dept.	Northwest Natural Gas Co.
Central Electric Coop, Inc.	Cascade Natural Gas Corp.
Central Lincoln Peoples Utility District	Northwest Natural Gas Co.
Centralia Light Dept.	Puget Sound Energy, Inc.
Cheney Light Dept.	Avista Corp.
Chewelah Light Dept.	Avista Corp.
Clark Public Utility District	Cascade Natural Gas Corp.
Clark Public Utility District	Northwest Natural Gas Co.
Clatskanie Peoples Utility District	Cascade Natural Gas Corp.
Clatskanie Peoples Utility District	Northwest Natural Gas Co.
Clearwater Power Co.	Avista Corp.
Columbia Basin Electric Coop, Inc.	Cascade Natural Gas Corp.
Columbia River Peoples Utility District	Cascade Natural Gas Corp.
Columbia River Peoples Utility District	Northwest Natural Gas Co.
Columbia Rural Electric Association, Inc.	Cascade Natural Gas Corp.
Columbia Rural Electric Association, Inc.	Avista Corp.
Consumers Power, Inc.	Northwest Natural Gas Co.
Coos-Curry Electric Coop, Inc.	Northwest Natural Gas Co.
Declo Municipal Electric Dept.	Intermountain Gas Co.
Douglas Electric Coop, Inc.	Northwest Natural Gas Co.
Douglas Electric Coop, Inc.	Avista Corp.
Drain Electric Dept.	Northwest Natural Gas Co.
East End Mutual Electric Co., Ltd.	Intermountain Gas Co.
Ellensburg Light & Gas Dept.	Cascade Natural Gas Corp.
Ellensburg Light & Gas Dept.	Ellensburg Light & Gas Dept.
Elmhurst Mutual Power & Light Co.	Puget Sound Energy, Inc.
Emerald Peoples Utility District	Northwest Natural Gas Co.
Energy Northwest, Inc.	NorthWestern Corp.

Eugene Water & Electric Board	Northwest Natural Gas Co.
Fall River Rural Electric Coop, Inc.	Intermountain Gas Co.
Farmers Electric Co., Ltd.	Intermountain Gas Co.
Fircrest Public Light Utility	Puget Sound Energy, Inc.
Flathead Electric Coop, Inc.	NorthWestern Corp.
Forest Grove Light & Power Dept.	Northwest Natural Gas Co.
Heyburn Electric Dept.	Intermountain Gas Co.
Hood River Electric Coop	Northwest Natural Gas Co.
Idaho Falls Electric Light Division	Intermountain Gas Co.
Idaho Power Co.	Cascade Natural Gas Corp.
Idaho Power Co.	Clark Fork & Blackfoot, LLC
Idaho Power Co.	Intermountain Gas Co.
Inland Power & Light Co.	Avista Corp.
Kootenai Electric Coop, Inc.	Avista Corp.
Lakeview Light & Power Co.	Puget Sound Energy, Inc.
Lane Electric Coop, Inc.	Northwest Natural Gas Co.
Lincoln Electric Coop, Inc.	NorthWestern Corp.
Lost River Electric Coop, Inc.	Intermountain Gas Co.
McCleary Light & Power Dept.	Cascade Natural Gas Corp.
McMinnville Water & Light	Northwest Natural Gas Co.
Midstate Electric Coop, Inc.	Cascade Natural Gas Corp.
Midstate Electric Coop, Inc.	Avista Corp.
Milton Electric Dept.	Puget Sound Energy, Inc.
Milton-Freewater Light & Power Dept.	Cascade Natural Gas Corp.
Minidoka Electric Dept.	Intermountain Gas Co.
Missoula Electric Coop, Inc.	NorthWestern Corp.
Modern Electric Water Co.	Avista Corp.
Monmouth Electric Dept.	Northwest Natural Gas Co.
Northern Lights, Inc.	Avista Corp.
Northern Wasco County Public Utility District	Northwest Natural Gas Co.
NorthWestern Energy	Great Falls Gas Co., Energy West MT
NorthWestern Energy	Montana Dakota Utilities Co.
NorthWestern Energy	Clark Fork & Blackfoot, LLC
NorthWestern Energy	Avista Corp.
NorthWestern Energy	Intermountain Gas Co.
NorthWestern Energy	Saco Municipal Gas Service
Ohop Mutual Light Co.	Puget Sound Energy, Inc.
Oregon Trail Electric Consumers Coop, Inc.	Cascade Natural Gas Corp.
Oregon Trail Electric Consumers Coop, Inc.	Avista Corp.
Pacific Power	Cascade Natural Gas Corp.
Pacific Power	Northwest Natural Gas Co.
Pacific Power	Avista Corp.
Parkland Light & Water Co.	Puget Sound Energy, Inc.
Peninsula Light Co.	Cascade Natural Gas Corp.

Portland General Electric Co.	Cascade Natural Gas Corp.
Portland General Electric Co.	Northwest Natural Gas Co.
PUD No. 1 of Asotin County	Avista Corp.
PUD No. 1 of Benton County	Cascade Natural Gas Corp.
PUD No. 1 of Chelan County	Cascade Natural Gas Corp.
PUD No. 1 of Cowlitz County	Cascade Natural Gas Corp.
PUD No. 1 of Cowlitz County	Northwest Natural Gas Co.
PUD No. 1 of Cowlitz County	Puget Sound Energy, Inc.
PUD No. 1 of Douglas County	Cascade Natural Gas Corp.
PUD No. 1 of Ferry County	Avista Corp.
PUD No. 1 of Franklin County	Cascade Natural Gas Corp.
PUD No. 1 of Grays Harbor County	Cascade Natural Gas Corp.
PUD No. 1 of Grays Harbor County	Puget Sound Energy, Inc.
PUD No. 1 of Kittitas County	Cascade Natural Gas Corp.
PUD No. 1 of Kittitas County	Ellensburg Light & Gas Dept.
PUD No. 1 of Klickitat County	Northwest Natural Gas Co.
PUD No. 1 of Klickitat County	Avista Corp.
PUD No. 1 of Lewis County	Cascade Natural Gas Corp.
PUD No. 1 of Lewis County	Puget Sound Energy, Inc.
PUD No. 1 of Mason County	Cascade Natural Gas Corp.
PUD No. 1 of Pend Oreille County	Avista Corp.
PUD No. 1 of Skamania County	Northwest Natural Gas Co.
PUD No. 1 of Skamania County	Avista Corp.
PUD No. 1 of Snohomish County	Cascade Natural Gas Corp.
PUD No. 1 of Snohomish County	Puget Sound Energy, Inc.
PUD No. 1 of Wahkiakum County	Cascade Natural Gas Corp.
PUD No. 1 of Wahkiakum County	Puget Sound Energy, Inc.
PUD No. 1 of Whatcom County	Cascade Natural Gas Corp.
PUD No. 2 of Grant County	Cascade Natural Gas Corp.
PUD No. 2 of Grant County	Avista Corp.
PUD No. 2 of Pacific County	Cascade Natural Gas Corp.
PUD No. 2 of Pacific County	Puget Sound Energy, Inc.
PUD No. 3 of Mason County	Cascade Natural Gas Corp.
Puget Sound Energy, Inc.	Buckley, City of
Puget Sound Energy, Inc.	Cascade Natural Gas Corp.
Puget Sound Energy, Inc.	Ellensburg Light & Gas Dept.
Puget Sound Energy, Inc.	Puget Sound Energy, Inc.
Puget Sound Energy, Inc.	Enumclaw, City of
Raft River Rural Electric Coop, Inc.	Intermountain Gas Co.
Ravalli County Electric Coop, Inc.	NorthWestern Corp.
Richland Energy Services Dept.	Cascade Natural Gas Corp.
Rocky Mountain Power	Clark Fork & Blackfoot, LLC
Rocky Mountain Power	Questar Gas Co.
Rocky Mountain Power	Intermountain Gas Co.

Rupert Electrical Dept.	Intermountain Gas Co.
Ruston Electric Utility	Puget Sound Energy, Inc.
Salem Electric Coop Association	Northwest Natural Gas Co.
Salmon River Electric Coop, Inc.	Intermountain Gas Co.
Seattle City Light	Puget Sound Energy, Inc.
Soda Springs Electric Light & Power	Intermountain Gas Co.
South Side Electric Lines, Inc.	Intermountain Gas Co.
Springfield Utility Board	Northwest Natural Gas Co.
Steilacoom Electric Dept.	Puget Sound Energy, Inc.
Sumas Electric Dept.	Cascade Natural Gas Corp.
Tacoma Public Utilities Light Division	Puget Sound Energy, Inc.
Tanner Electric Coop	Puget Sound Energy, Inc.
Tillamook Peoples Utility District	Northwest Natural Gas Co.
Umatilla Electric Coop Association	Cascade Natural Gas Corp.
Umpqua Indian Utility Coop	Avista Corp.
United Electric Coop, Inc.	Intermountain Gas Co.
Vera Irrigation District No. 15	Avista Corp.
Vigilante Electric Coop, Inc.	NorthWestern Corp.
Vigilante Electric Coop, Inc.	Intermountain Gas Co.
Wasco Electric Coop, Inc.	Cascade Natural Gas Corp.
Wasco Electric Coop, Inc.	Northwest Natural Gas Co.
Weiser Water & Light Dept.	Intermountain Gas Co.
West Oregon Electric Coop, Inc.	Northwest Natural Gas Co.