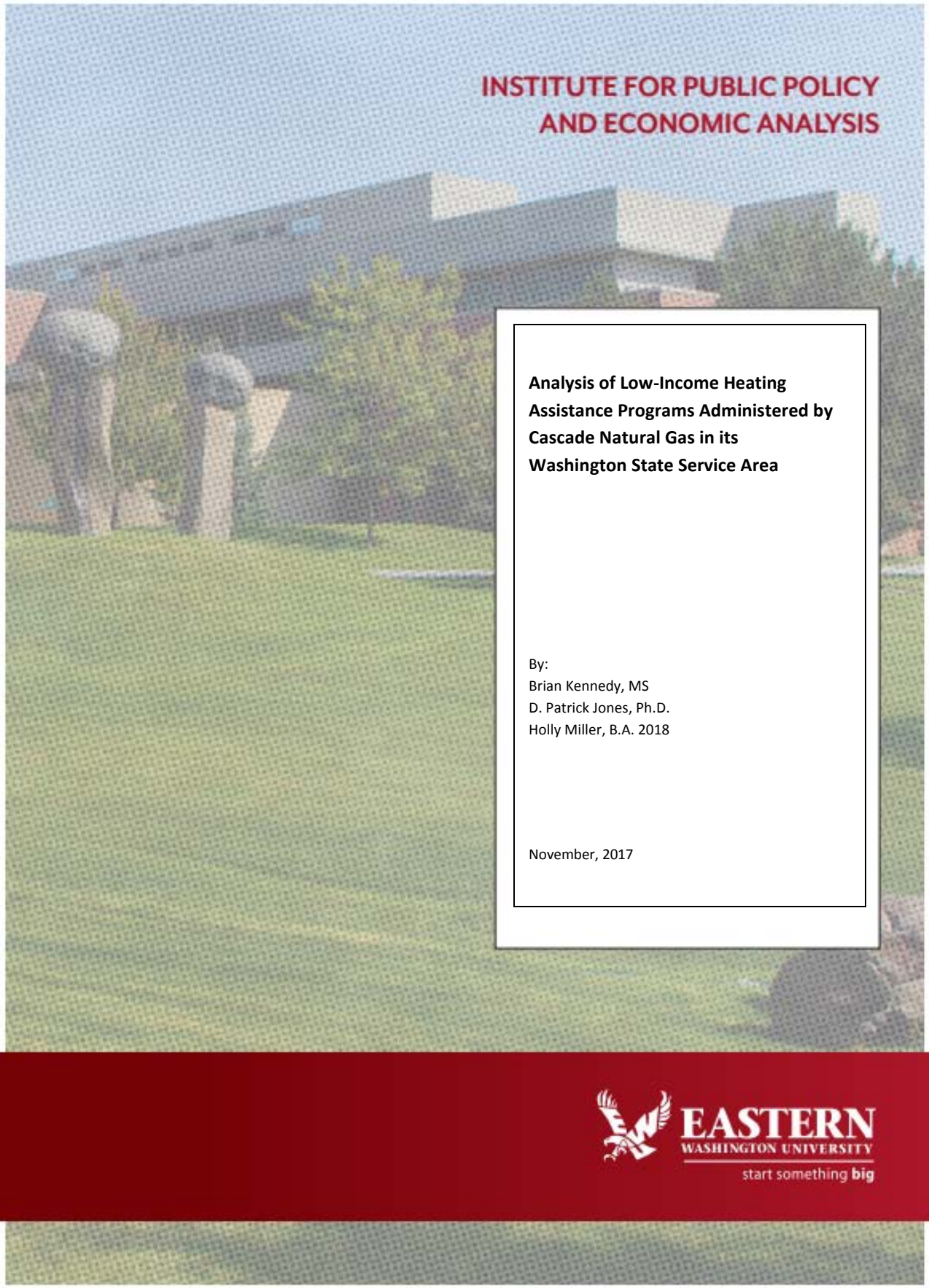

INSTITUTE FOR PUBLIC POLICY AND ECONOMIC ANALYSIS

Analysis of Low-Income Heating Assistance Programs Administered by Cascade Natural Gas in its Washington State Service Area

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November, 2017

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start something big

Analysis of Low-Income Heating Assistance Programs Administered by Cascade Natural Gas in its Washington State Service Area: Based on the 150% Federal Poverty Level (FPL) with Revisions to the 125% FPL

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Executive Summary

This study was conducted as a revision to a prior one undertaken by the Institute of Public Policy & Economic Analysis (the Institute) in May, 2017. In both, Cascade Natural Gas (CNG) asked the Institute to pursue the same objectives. First, it wanted an accurate number of households in their service area in Washington State that could potentially qualify for natural gas subsidies, covering those households at or below the 125% Federal Poverty Level (FPL) income threshold and in this version, the 150% FPL threshold as well. Second, CNG wanted to uncover what has been dubbed the penetration ratio, or the share of households enrolled in natural gas heat subsidies compared to the total number of potential households qualifying for subsidies. These shares, too, were estimated at the 125% and 150% FPL thresholds in this version.

The third objective was to determine how large of a percentage of a CNG consumer's household income goes toward spending on natural gas heat (the burden). The study conducted in May contained inaccurate data about the amount that subsidized (those receiving heating assistance) households spent on heating. In particular, the earlier study represented the amount billed to households and did not factor in the subsidies, resulting in net heating expenditures that were too high, and consequently over estimating the true heating burden. This study accounts for this misstep by incorporating net spending, or the amount billed minus the subsidies granted, of the subsidized households.

All CNG data came from the years of 2013 to 2015 and all were coded at the census tract level by the company. Additionally, the dataset was disaggregated by service district. Census tracts are a key unit of measure for the U.S. Census, numbering typically 4,000-5,000 people, but with a range of 1,200-8,000 people. All Census data, specifically from the American Community Survey (ACS), came from the most recent five year estimates, taken over the years 2011-2015.

The first outcome variable estimated in the revision were the potential households qualifying for natural gas heat subsidies in the CNG service area of the state. There were 28,024 households qualifying at the 125% FPL and 34,814 households qualifying at the 150% FPL, after taking into account households that currently use natural gas as a primary heating source. Over 75% of the households that qualify at the 150% FPL fall into just four service districts: Bellingham, Bremerton, Mount Vernon, and Yakima. These represent the districts primed for potential expansion of these low income programs.

Expanding on the first outcome, the Institute research team calculated the penetration ratio across the CNG service area. This was defined as the ratio of the number of households receiving heating assistance compared to the number that could receive it (after considering only those households currently using natural gas as a primary heating source). This first part of this analysis was done as a revision to study's analysis at the 125% FPL income threshold; the second, as a completely new estimate for the 150% FPL income threshold. The revision for the 125% FPL threshold was due to a slightly different data set of CNG residential customers from the prior study.

The revised penetration ratio at the 125% FPL threshold for the entire CNG service area was 10.4%; at the 150% FPL threshold, it was 8.4%. As in the last study, Wenatchee ranked the highest of all districts with a penetration ration of 15.3% at the 125% FPL and 11.9% at the 150% FPL. This result was 4.9 and 3.6 percentage points higher, respectively than the CNG service area average.

Conversely, the districts of Longview (2.3%) and Kennewick (5.2%) showed substantially lower penetration of these programs compared to the other districts. While Longview has a relatively low number of household eligible for subsidies, Kennewick on the other hand has over 3,000 households and could be the district with the greatest expansion potential.

The penetration percentages represent the lower bound of estimates. Why? In lieu of detailed information about natural gas distribution by income levels, the Institute team assumed that those living at or below the two FPL thresholds heated with natural gas in the same proportion as the overall population. This is likely not the case, as lower income neighborhoods do not enjoy equal access to this heating source as average or higher income ones do. As a result, the denominators used in the construction of the ratio are higher than they really are, leading to penetration ratios that are lower than the true values. But it is difficult to say how large a difference this is.

The last outcome measure addressed in this study was the heating burden facing both subsidized and unsubsidized households in the CNG service area. The burden is simply the share of household income spent on natural gas heating. Since the Institute did not have access to income and heating expenditure by household, values of household income central values – means and medians – were taken from the ACS for each census tract. They then formed the denominator of a ratio, by census tract, in which CNG expenditure data formed the numerator.

The results from this portion of the project are vastly different than those from the May analysis. This is due to an adjustment in the household spending dataset provided to our research team from CNG.

This iteration of the dataset accurately addresses the net spending of the subsidized households after assistance program dollars have been applied to their billed amount.

The Institute provides estimates based on both the median and average spending and income for both subsidized and unsubsidized households. There was little variation between the average and median estimates. Average spending on heat for the unsubsidized households for the CNG service area was $518, averaged across 2013-2015. This was $426 higher than the subsidized household average of just $92. These equated to a heating burden of 0.8% (unsubsidized) and 0.5% (subsidized). These results conform to national results for natural gas heat from the U.S. Bureau of Labor in its Consumer Expenditure Survey.

In this analysis, there were only marginal differences among the unsubsidized households, with the Aberdeen, Bremerton, Walla Walla, and Yakima all at an average burden at 0.9%, while the Kennewick district showed the lowest average burden at just 0.7%. The average burden, statewide for CNG's service districts was 0.8%.

Slightly more variation for the subsidized households was found, due to the Longview district having a substantially higher average heating burden of 1.2%. However, Longview represented a very small share of the overall CNG service area and removing it from the sample resulted in all districts falling within 0.2 percentage point range from the CNG service area average. This average was 0.5%.

The true burden for these households is likely higher, although the difference from 0.5% cannot be computed. This is because the denominator of the ratio used for this customer class is the 125% FPL. It is impossible to know for sure the true mean or median of this group of households, but it is undoubtedly lower. In lieu of this unknown

value, the Institute used the one number available, the 125% FPL threshold. A lower denominator would obviously increase the ratio.

Like the prior study, this version includes a number of maps as well. While the primary unit of analysis in the write up has been at the CNG service district level, the final chapter maps out the estimates found in the prior sections at the census tract level. This was done to give a visual sense of variation within the districts. The maps included in cover the three main outcome variables, potential households eligible, the penetration ratio, and the heating burden.

2. Data and Methods

2.1 American Community Survey and Cascade Natural Gas Data

This analysis rests, as in the prior study submitted in May, on two sources of data. The first comes from Cascade Natural Gas (CNG) and is based on their residential customers for the years 2013-2015 in Washington State. The dataset contains usage expenditures and is geocoded to indicate both its CNG service district assignment and its corresponding census tract. In contrast to the May CNG dataset, the heating subsidy amounts were more accurately reflected in this version. A census tract is a key unit of measure by the U.S. Census and is generally comprised 4,000-5,000 people. The demarcation of the nine CNG service districts in Washington State by census tracts was provided to the Institute by CNG. This dataset is rather large, comprised of 272 census tracts, consisting of an average of 214,066 subsidized and unsubsidized household records per year, across 2013-2015.

Poverty and heating measures come from the American Community Survey (ACS) of the U.S. Census. The ACS is the largest survey undertaken annually in the world, with over 3 million individuals queried annually. To arrive at the first variable of interest, the Institute research team examined the share of the population living at or below a certain threshold of the Federal Poverty Level (FPL). The census tract estimates pulled from the ACS were then weighted, based on population, to provide district wide estimates matching those services areas outlined by CNG.

This study primarily focuses on those households at or below the 150% poverty level, but lists the threshold used from the prior study, 125%. This is done for two reasons: first, for side by side comparison; and second, the dataset provided by CNG for this study varied slightly from the prior version thus creating the need for estimates specific to the 125% FPL rates to be recalculated.

Table 2.1 Shares of the Population Living at or Below 2015 Poverty Levels in CNG Service Districts		
District	Shares Based on 125% of the Federal Poverty Threshold	Shares Based on 150% of the Federal Poverty Threshold
Aberdeen	24.5%	29.7%
Bellingham	21.1%	25.9%
Bremerton	16.4%	20.1%
Kennewick	19.2%	25.2%
Longview	27.4%	33.5%
Mount Vernon	17.7%	21.9%
Walla Walla	24.7%	29.3%
Wenatchee	20.5%	26.6%
Yakima	30.0%	37.2%
CNG Service Area	***21.7%***	***27.0%***

Table 2.1 shows the calculated shares of the population living at or below the two poverty rates for the CNG districts, using the new dataset supplied by the company. These shares are comprised of only those census tracts that contain households in which CNG billed at least one home during the years of 2013, 2014, and 2015 and is based on the 2015 ACS 5-year estimates.

As in the first version of the study, the Yakima district again is the district with the highest share of its population living at or below the 150% FPL, with 37.2% of the population falling into this category over the period 2011- 2015. Yakima's share is almost four percentage points higher than the next closest district, Longview, at 33.5%, and over ten percentage points higher than the sample weighted average at 27%. Bremerton and Mount Vernon are the two districts with the lowest shares of the population living at or below the FPL, at 20.1% and 21.9%, respectively. These rates are not unexpected as they mirror that of the prior study at the 125% poverty level as well.

3. Outcome Measures

3.1 Potential household Qualifying for Energy Assistance

The first outcome measure that the research team was asked to re-estimate was the total number of households that qualify for energy assistance. Subsidized households largely fall into two energy assistance programs: Low Income Energy Assistance Program (LIHEAP) and the Washington Energy Assistance Fund (WEAF). LIHEAP is a federally funded program for qualified households that provide a one-time benefit (per program year) to assist with heating costs. WEAF is a state based cost recovery program to assist qualified low income customers with utility bill assistance. The initial study based qualification for subsidies on household income falling at or below 125% of the federal poverty level (FPL). In order to assess potential expansion of these programs to those households falling at 150% of the FPL or below, the Institute was asked to determine the number of these households. The income thresholds for both FPLs and the acceptance into the two energy assistance programs vary by household size. Table 3.1a depicts the upper bounds of the income that households may have to qualify for LIHEAP and the relevant poverty level thresholds by household size. As eligibility is based on both income and household size, the Institute

Table 3.1a Poverty and LIHEAP Maximum Household Income Standards

Household Size	WA LIHEAP Income Threshold	2015 Federal Poverty Threshold	125% Federal Poverty Threshold	150% Federal Poverty Threshold
1	$14,850	$11,770	$14,713	$17,655
2	$20,025	$15,930	$19,913	$23,895
3	$25,200	$20,090	$25,113	$30,135
4	$30,375	$24,250	$30,313	$36,375
5	$35,550	$28,410	$35,513	$42,615

followed the same methodology adopted in the May study. Since the ACS poverty estimates are provided for individuals only and since the desired unit of measure is households, a simplifying assumption was necessary. Namely, the team assumed that those households at or below the 150% FPL showed the same size structure as all households in each census tract. The Institute used ACS estimates to obtain the total number of households by household size within each census tract. In addition, the ACS provided estimates of the share of the population at or below 125% and 150% FPL within these same census tracts. From here the team applied this share to the distribution of households by size, allowing us to estimate the number of *households* within a census tract that fell at this poverty level based on their household size. Table 3.1b shows these estimates for the entire CNG service area by district, including 125% estimate from the revised dataset provided by CNG and the newly estimated counts at the 150% poverty level.

3.1b Potentially Qualifying Households for Heating Assistance, 2011-2015 in CNG's Service Districts				
District	Potential Households Qualifying for Subsidies at 125% Federal Poverty Level	Share of All Occupied Households Eligible at the 125% Federal Poverty Level	Potential Households Qualifying for Subsidies at 150% Federal Poverty Level	Share of All Occupied Households Eligible at the 150% Federal Poverty Level
Aberdeen	6,863	23.2%	8,220	27.8%
Bellingham	16,065	20.9%	19,755	25.7%
Bremerton	12,444	16.7%	15,079	20.2%
Kennewick	15,371	18.9%	20,437	25.2%
Longview	8,750	23.8%	10,833	29.5%
Mount Vernon	13,171	17.3%	16,490	21.7%
Walla Walla	4,569	22.9%	5,422	27.1%
Wenatchee	9,413	20.7%	12,257	27.0%
Yakima	21,382	28.0%	26,679	34.9%
Total/Average Share	***108,028***	***20.9%***	***135,172***	***26.1%***

In the CNG service area, 108,028 households were potentially eligible for subsidies. (Note that this number is slightly different than that of the study in May due to changes in the census tracts across the datasets.) Just over 20% of the households fall at or below the 125% FPL with a majority of these households coming from the districts of Yakima (21,382), Bellingham (16,065) Kennewick (15,371), Mount Vernon (13,171), and Bremerton (12,444). When the income threshold is expanded to 150% of the FPL, 26.1% of the households in the CNG service area would qualify. This is an expansion of just over 27,000 households over the 125% FPL. Kennewick showed the largest percentage change of households qualifying for assistance, at a 33% increase, while Walla Walla showed the lowest growth, at 18.7%.

As with the analysis in the prior study, these estimates do not take into account those households that are currently using natural gas as their heating source. It simply captures all households potentially eligible based on their household size and income. Table 3.1c applies the share of households who are already using natural gas as their primary fuel source (taken from ACS census tract data) to those potentially eligible households found above in table 3.1b. The study team recognizes that this assumes lower income households use natural gas as a primary heating source with the same propensity that all households would. The rate is likely lower, but no data were available to modify this assumption. As a result, these estimates found in the table below offer upper bounds on the total number of households that currently qualify for participation in the CNG's energy assistance program based on the 125% and 150% FPL given the upward bias of applying the share using natural gas.

At the 125% poverty threshold, 28,024 households, or 19.3% of the total occupied households in the CNG service area, potentially qualify for energy assistance programs. Expanding the threshold to 150% of the FPL yields 34,814 households that qualify. This is a growth rate of nearly 25% over the lower FPL threshold and would account for 24% of all the households in

the CNG service area. The districts with the largest share of households qualifying are Yakima at 32.2% and Aberdeen at 30.4%. In absolute terms the Bellingham district represents the largest total number of households as well at 8,320. Mount Vernon (6,902 households), Yakima (6,612 households), and Bremerton (5,099 households) all have notably high numbers of potentially qualifying households. These four districts alone comprise 77% of all qualifying households across the CNG service area. On the opposite end of the spectrum, the Longview and Wenatchee service districts show the lowest potential expansion in the energy assistance programs at the higher FPL threshold, with just a combined total of 1,349 households, or just 4% of all eligible households within the CNG service area.

3.1c Potentially Qualifying Households for Heating Assistance That Use Natural Gas, 2011-2015

District	Adjusted Potential Households Qualifying for Subsidies: 125% Federal Poverty Level	Share of All Adjusted Occupied Households Eligible: 125% Federal Poverty Level	Adjusted Potential Households Qualifying for Subsidies: 150% Federal Poverty Level	Share of All Adjusted Occupied Households Eligible: 150% Federal Poverty Level
Aberdeen	1,100	25.7%	1,301	30.4%
Bellingham	6,696	19.2%	8,320	23.8%
Bremerton	4,191	16.9%	5,099	20.5%
Kennewick	2,386	15.2%	3,197	20.4%
Longview	469	18.1%	604	23.3%
Mount Vernon	5,567	17.7%	6,902	21.9%
Walla Walla	1,729	21.5%	2,034	25.3%
Wenatchee	580	22.3%	745	28.6%
Yakima	5,306	25.8%	6,612	32.2%
CNG Service Area	**28,024**	**19.3%**	**34,814**	**24%**

While these estimates look specifically at the potential, they don't account for those households already participating in energy assistance programs through CNG. It only looks at eligibility; in fact, some of these eligible households may already be taking advantage of the energy assistance program. The following section will look into how well CNG is addressing the needs of these households.

3.2 The Penetration Ratio of Heating Assistance Programs in CNG's Service Territory

The *penetration ratio* refers to the number of CNG-served households enrolled in energy assistance programs compared to number of households eligible for the programs. This measure gets at the heart of how well CNG is providing assistance to these households. The same methodology used in the prior study was implemented here. From CNG, the Institute was supplied with the revised three years' worth of data, 2013-2015, providing counts by census tract of households enrolled in heating assistance programs. These were then averaged across the three years to smooth out any single year exogenous fluctuations. Using these data, the research team calculated the share of households enrolled in the subsidies in relation to the total eligible households, estimated in section 2.1.

The first column of table 3.2a lists the average number of households, by district, enrolled in heating subsidy programs through CNG during three years, 2013-2015. Across the entire service area, an average of 2,907 households participated in the subsidies, with a majority coming from the districts of Bellingham, Yakima, and Mount Vernon. The second column of estimates contains the revised penetration ratio based on all households whose income falls at or below 125% of the FPL using the new CNG dataset. Even with the new data, these estimates are nearly identical those of the study conducted in May. The Aberdeen district displayed the largest variance from the prior study but the difference was small, increasing just 0.3%. Given the slight variation across the entire CNG service area between the current and the prior data set, the overall penetration ration at the 125% rate stayed the same, at 2.7%.

Table 3.2a Enrollment and Penetration Ratios in Heating Assistance Programs in the CNG Service Area, 2013-2015			
District	3-Year Average No. of Households Enrolled in Energy Assistance	Penetration Ratio of All Households at the 125% FPL	Penetration Ratio of All Households at the 150% FPL
Aberdeen	128	1.9%	1.6%
Bellingham	770	4.8%	3.9%
Bremerton	444	3.6%	2.9%
Kennewick	165	1.1%	0.8%
Longview	14	0.2%	0.1%
Mount Vernon	562	4.3%	3.4%
Walla Walla	173	3.8%	3.2%
Wenatchee	89	0.9%	0.7%
Yakima	562	2.6%	2.1%
CNG Service Area	***2,907***	***2.7%***	***2.2%***

Similar to the 125% rate estimates, loosening the eligible income threshold up to 150% of the FPL only puts slight downward pressure on the penetration estimates. The overall penetration ratio dropped 0.5 percentage points from the current to the more generous threshold, to just 2.2% of all eligible households participating in the subsidy programs offered through CNG. Note that these calculation are based on income only, and not restricted to only natural gas-using households. At this threshold, the Bellingham (3.9%), Mount Vernon (3.4%), and Walla Walla (3.2%) service districts sported the highest rates of households participating, while Longview (0.1%), Wenatchee (0.7%) and Kennewick (0.8%) service districts carried the lowest penetration rates. These are largely reflected of the districts with the highest and lowest number of average households enrolled in the subsidies. Bellingham, the high, had an average of 770 households enrolled from 2013-2015.

However, with Longview having just an average of 14 households and Wenatchee with 89, low rates are to be expected. Since the heating assistance programs do not target all households but only those that are CNG customers, a more relevant penetration ratio calculation uses the Census-defined base of all natural gas users. Similar to the calculations used in table 3.2a, the research team reduced the total potential households by the share of households currently using natural gas a primary heating source.

We define this as the *Adjusted Penetration Ratio*. It more accurately addresses the assessment question, if given the perfect dissemination of information and funds were available, these households could enroll in energy assistance tomorrow. Table 3.2b depict these ratios for households with incomes at or below 125% and 150% of the FPL. While the 125% rates have been recalculated based on the newest CNG dataset for comparability, the 150% estimates are entirely new per this study. Given the likely upward bias in the estimates of potentially eligible households in table 3.1c, the estimates provided in the following table would represent the lower bound of the share of natural gas using eligible households enrolled in subsidies. In other words, the current penetration ratio is probably higher, as would be one based on the 150% FPL. With this adjustment, 10.4% of the households eligible (based on the 125% poverty level) and 8.4% of the

Table 3.2b Enrollment and Penetration Ratios in Heating Assistance Programs in the CNG Service Area, 2013-2015		
District	Natural Gas User Adjusted Penetration Ratio at 125% Federal Poverty Level	Natural Gas User Adjusted Penetration Ratio at 150% Federal Poverty Level
Aberdeen	11.6%	9.8%
Bellingham	11.5%	9.3%
Bremerton	10.6%	8.7%
Kennewick	6.9%	5.2%
Longview	3.0%	2.3%
Mount Vernon	10.1%	8.1%
Walla Walla	10.0%	8.5%
Wenatchee	15.3%	11.9%
Yakima	10.6%	8.5%
CNG Service Area	***10.4%***	***8.4%***

eligible households (based on the 150% rate) are enrolled in subsidies. This is a marked increase from the estimates in table 3.2a, by 7.7 percentage points for the 125% income threshold, and 6.2 percentage points at the 150% income threshold. Once adjusted for natural gas use, Wenatchee moved from one of the districts with the lowest penetration ratios to the district with the highest adjusted penetration ratio, at 11.9% at 150% of the FPL. The Aberdeen district, at 9.8%, also showed quite a substantial jump of 8.2 percentage points as well. The districts of Longview, at just 2.3%, and Kennewick, at 5.2%, showed only modest changes.

3.3 Heating Burden

The remaining portions of section 3 take up the heating spending of both those households, with and without energy assistance. Specifically, the research team analyzed how much of household income was allocated to heat from natural gas in the service area, averaged over the years 2013-2015. This ratio constitutes the burden. With the revised data supplied by CNG, the Institute team was able to calculate median and average household spending on heat at the census tract level.

3.3.1 Median Heating Burden

In order to understand the heating burden facing households, it is important to look at the median spending of both the subsidized and unsubsidized households in the CNG service area. "Subsidized" refers to those households receiving some heating assistance; "unsubsidized" refers to those households with no heating assistance. Table 3.3.1a provides the median household spending, the median subsidy received, and the difference between the household spending between subsidized and unsubsidized households by district

Table 3.3.1a Median Spending on Heat in Households Served by Cascade Natural Gas, 2013-2015

District	Median Household Spending by Unsubsidized Households	Median Household Spending by Subsidized Households	Median Subsidy Received	Difference Between Unsubsidized and Subsidized
Aberdeen	$497	$174	$296	$323
Bellingham	$534	$75	$426	$460
Bremerton	$518	$86	$350	$431
Kennewick	$487	$164	$330	$323
Longview	$405	$238	$311	$167
Mount Vernon	$526	$105	$390	$421
Walla Walla	$459	$96	$392	$363
Wenatchee	$360	$55	$418	$305
Yakima	$475	$100	$399	$375
Sample Weighted Average	***$505***	***$98***	***$384***	***$407***

Throughout the entire CNG service area, the median household spending on natural gas for heat by unsubsidized households was $505. This amount is $407 more than that of the subsidized households, who paid just $98 paid out of pocket. Or, this overall median represents a reduction of $384 between the two classes of households. The size of this difference represents a substantial departure from the data set of the prior study.

The districts of Bellingham ($534), Bremerton ($518) and Mount Vernon ($526) all showed the highest unsubsidized household spending of the nine districts. The districts with the highest median subsidized (actual amount billed minus the subsidy) household spending were Longview ($238), Aberdeen ($174), and Kennewick ($164). With regard to the median subsidy received, the districts of Bellingham, at $426, and Wenatchee at $418, revealed substantially higher subsidy amounts than the median for the entire CNG service area. The districts of Aberdeen, at $296, and Longview, at $311, were among the districts with the lowest median subsidy dollars.

Using the data taken from table 3.3.1a, our research team was able to combine the median household income data taken from ACS in those census tracts within CNG's service area to address the final main objective of this study, the heating burden. This was done in order to understand how much households allocate for heat with respect to their overall household income. The methodology follows suit of that one conducted in May. For the unsubsidized households the ratio was created using the median amount paid for heating divided by the median household income in that census tract. Each census tract's results were then then averaged, weighted by population, to the district level. The results are presented in table 3.3.1b.

A similar calculation is at work for the subsidized households. Here, the study team also took the heating expenditure medians, at the census tract level, embodied in the district results in the second column of table 3.3.1a. Instead of median household income in each tract, however, the team used the 125% federal poverty level (FPL) based on the census tracts' average household size as the income measure. For non-integer results, the team rounded up. That is, a census tract with an average household size of 2.5 would be assigned the FPL for a household of 3. This is because currently all households to qualify for the subsidy must fall at or below this income level. Further analysis of this methodology can be found in the prior study. With these

Table 3.3.1b Median Heating Burden, 2013-2015

District	Median Heating Burden for Unsubsidized Households	Median Heating Burden for Subsidized Households
Aberdeen	1.1%	0.8%
Bellingham	1.0%	0.3%
Bremerton	1.0%	0.6%
Kennewick	0.8%	0.7%
Longview	0.9%	1.2%
Mount Vernon	1.0%	0.6%
Walla Walla	1.0%	0.5%
Wenatchee	0.8%	0.3%
Yakima	1.1%	0.5%
CNG Service Area	***1.0%***	***0.6%***

considerations in mind, one can examine the results. Across the entire CNG service area, a median of roughly 1% of an unsubsidized household's income went toward heating. After receiving the subsidies, subsidized households faced a median share of out of pocket expenditures as a share of household income (here the 125% FPL) of 0.6%.

While the unsubsidized households' heating burden is relatively unchanged from the prior study's results, the same is not true for the unsubsidized households. With the revised CNG dataset, the subsidized households' heating burden fell by two percentage points compared to the prior study (2.6% in May). Mirroring the data found in table 3.3.1a, the districts with the highest heating burden for subsidized households were Longview (1.2%) and Aberdeen (0.8%). The districts with the lowest heating burden for the same group were Bellingham and Wenatchee, at just 0.3%. In addition, one can detect substantial variation between the districts with regard to the subsidized households, as there is nearly a one percentage point spread between the highest and lowest heating burden districts. For the unsubsidized households there is only a 0.3 percentage point difference.

It must be noted that the heating burden calculations for the subsidized households represent the *best case scenario* for this group. That is because it is highly likely that many of those households were characterized by incomes at considerably less than the 125% of the FPL. With a smaller denominator, the resulting burden ratio will be larger. The absence of data, however, compels us to use the only known income number, which represents upper bound of income for this group. As a result, the actual median burden is likely considerably higher.

3.3.2 Average Heating Burden

While section 3.3.1 focuses on median *v*alues, section 3.3.2 takes the same methodology but uses *average* annual spending and average household income to analyze the heating burden. Table 3.3.2a depicts the average annual household spending on natural gas heat across the nine CNG service districts using the revised dataset. A comparison of average spending to the median spending estimates reveals that the averages are slightly higher across the board, with the exception of subsidized household spending on heat. However, overall the changes are quite minor.

For the entire CNG service area, the annual average heating expenditure was only $13 higher for the unsubsidized households than the median, while it was just $6 lower for the subsidized households. The average annual subsidy dollars received was $420, or about $36 more than the median estimates for those subsidized households. Similar to the median estimates, Bellingham ($550), Aberdeen ($531), Mount Vernon ($536) and Bremerton ($523) were the districts with the highest average household spending on natural gas heat for the unsubsidized households. Likewise, Wenatchee ($412) and Longview ($451) rounded out the districts with the lowest household spending.

Table 3.3.2a Average Household Spending on Heat for those Households Served by Cascade Natural Gas, 2013-2015.				
District	Avg. Household Spending by Unsubsidized Households	Avg. Household Spending by Subsidized Households	Avg. Subsidy Received	Difference Between Unsubsidized and Subsidized
Aberdeen	$531	$158	$389	$373
Bellingham	$550	$85	$441	$464
Bremerton	$523	$67	$395	$456
Kennewick	$483	$133	$358	$349
Longview	$451	$267	$317	$184
Mount Vernon	$536	$87	$448	$449
Walla Walla	$481	$115	$402	$365
Wenatchee	$412	$63	$408	$349
Yakima	$496	$92	$431	$404
CNG Service Area	***$518***	***$92***	***$420***	***$426***

Interestingly, for subsidized households Longview households, at $267 per year, pay nearly three times as much as the CNG service area average. This is likely due to subsidized households in Longview receiving $103 fewer subsidy dollars than the service area average. However, these results must be viewed as a likely consequence of a small number: only 14 subsidized households in the entire district were part of the dataset, leading to high variability in the estimates compared to those districts with a greater number of households.

Given that the average annual heating spending across the CNG service area stay relatively similar compared to their median counterparts, one would expect to see similar results when evaluating the average annual heating burden. As observed in table 3.3.2b, this seems to generally hold true.

Similar to the study conducted in May, the average annual household income was nearly $13,000 higher that the median household income based on ACS data in the census tracts within the CNG service area. This served to offset the minor increase average household spending on heat. As a result, this lead to a slight drop in the average heating burden of unsubsidized households by 0.2 percentage points versus the median burden, falling to 0.8% over the entire CNG service area. For the subsidized households, the denominator is the same in both sets of calculations: the 125% FPL. Since the average out of pocket household expenditures on natural gas heat decreased marginally for this group, the minor drop of the heating burden by 0.1 percentage points to just 0.5% of household income is not surprising.

Table 3.3.2b Average Heating Burden, 2013-2015		
District	Average Heating Burden for Unsubsidized Households	Average Heating Burden for Subsidized Households
Aberdeen	0.9%	0.7%
Bellingham	0.8%	0.4%
Bremerton	0.9%	0.5%
Kennewick	0.7%	0.6%
Longview	0.8%	1.2%
Mount Vernon	0.8%	0.5%
Walla Walla	0.9%	0.6%
Wenatchee	0.8%	0.4%
Yakima	0.9%	0.4%
CNG Service Area	***0.8%***	***0.5%***

As a point of reference, the natural gas heating share of household expenditures nationally most recently averaged in the 0.6-0.7% range, depending on household size. These are the data from the 2016 Consumer Expenditure Survey, conducted by the U.S. Bureau of Labor Statistics. The results of the calculations in Table 2.3b are consequently consonant with national averages.

An examination of the results for specific districts within the CNG service area shows that the results from the average heating burden mimic those of the median heating burden. There isn't much variation in the unsubsidized heating between the districts, with the lowest districts sitting at 0.7% and the highest districts at just 0.9%. As observed in the prior section, a comparison of the results for table 3.3.2b and that of 3.3.1b reveals some variation among the subsidized households. The lowest heating burden sits at 0.4% and the highest at 1.2%. However, once the Longview district is removed from the list, most of the districts sit within 0.2% of the CNG service area average.

4. Assumptions and Caveats

This study has had to adopt some simplifying assumptions and therefore some caveats are in order. Most of these assumptions come from the limited socioeconomic characteristics the study team had at its disposal about CNG-served households, leaving us to rely on survey data from the American Community Survey (ACS) of the U.S Census Bureau. While these are typically minor caveats, they should be noted. The following assumptions and caveats coincide with those from the study done in May in order to have as direct comparability as possible.

First, all data from the ACS are based on a survey and not an actual count. Since the unit of measure for the report is the census tract, with populations varying from 1,200 to 8,000, the estimates often come with substantial margins of errors. Those census tracts with very few households to survey will have higher margins of error than those with more. However, the estimates ACS produces come with a 90% confidence level, due to the number of responses collected over a 5 year period. As the same methodology is used across all census tracts, the study team is confident that there is no inherent positive or negative bias associated with the ACS estimates.

The second caveat is a little more detailed. As the Institute didn't have income data for the subsidized households, we decided to using the 125% Federal Poverty Level (FPL) based on the household size within the census tract to estimate the subsidized households' annual income. While much of the analysis focuses on the potential expansion to the 150% poverty threshold with regards to calculating the heating burden the 125% FPL was still used for the share or burden analysis. This was done since it constitutes the current income threshold used as a basis for LIHEAP, the subsidy that accounts for a majority of the households participating in energy assistance programs offered through CNG. As a consequence, this isn't directly a median nor average annual income of that sub-group; rather, the level more represents the maximum annual income that the households could have. Recall that to be enrolled in subsidy programs, households cannot exceed the limit at 125% of the FPL threshold. As the maximum income was used instead of a true median/average for this subgroup, the study team believes that the heating burden estimates are an underestimation of what they really are, but the magnitude is unknown.

Finally, there were further assumptions needed in order to arrive at accurate estimates for the study. First, in order to adjust the number of potential households qualifying for subsidies, the study team had to reduce the number of household falling in the 125% and 150% poverty threshold by the share of households currently using natural gas as a heating source. As we only have heating source data for *all* households in the census tract, we had to assume that those households in poverty had natural gas usage rate similar to that of the overall population. We believe that this assumption overestimates the number of household eligible for subsidies through CNG because it is likely that lower income households will typically be renters, who rely on mainly electric heating, or live in older homes, which are less likely to use natural gas. The result of this approach: a likely underestimate of the penetration ratio of energy assistance programs.

The final assumption deals with the estimation of the households that fall below the 125% and 150% federal poverty threshold. As the poverty rate is based on household size, the study team had to assume that the distribution of household

size for those in poverty was the same as the distribution of households by size for the entire population in the census tract. This effects the calculation of the number of potential households qualifying for the subsidies, but there is no way to determining the true estimates, i.e., an upward or downward bias.

5. District Maps by Census Tract

While the previous sections focused around the district level section 5 provides a visual representation of data. The research team has provided maps for many of the outcome variables included in the study. This was done to show the variation at a census tract level within each district. The initial map depicts the entire CNG service area within Washington State, but the remaining maps have been grouped district. Provided below is a complete list of all variables that have been mapped for each district.

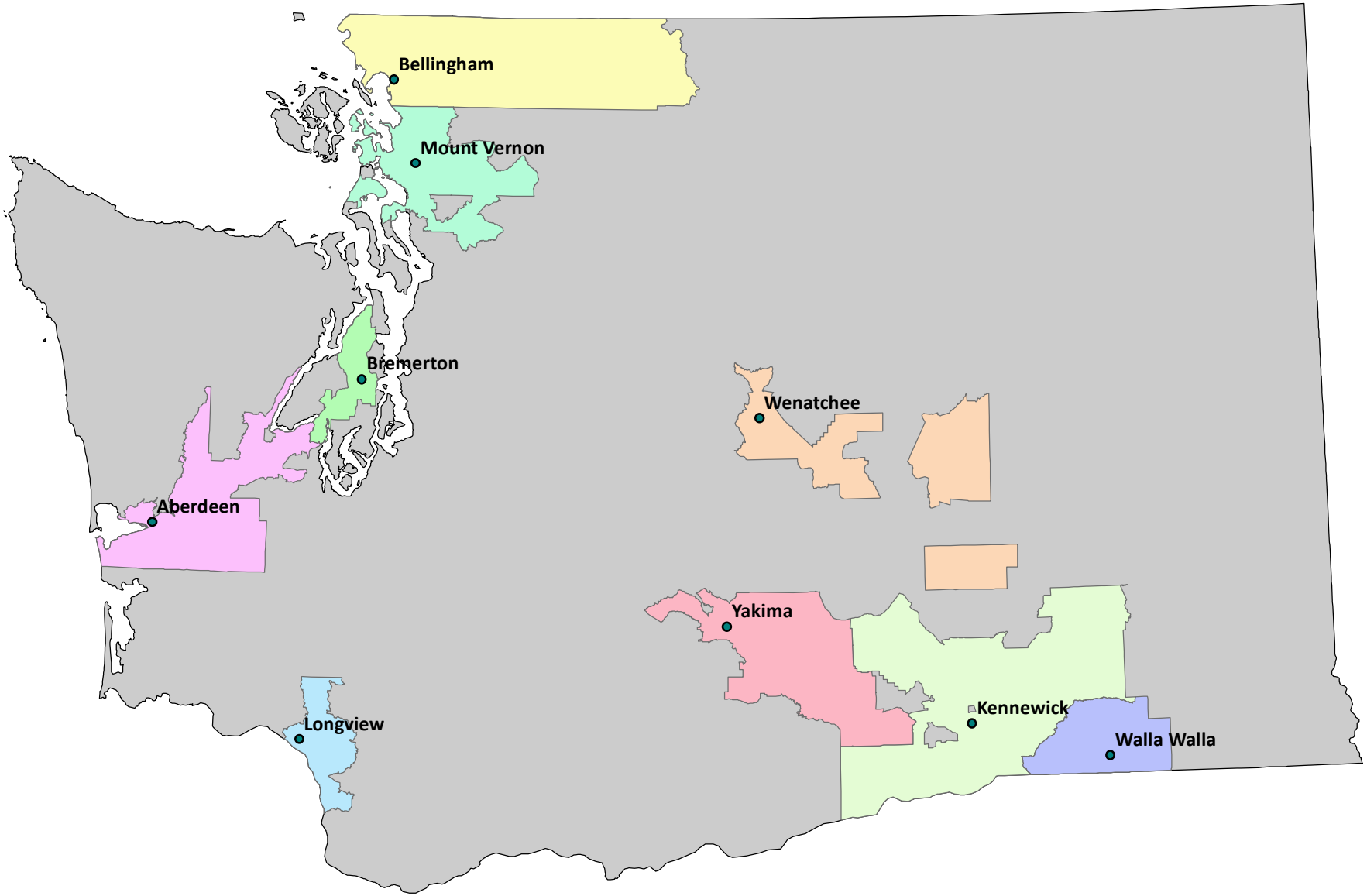
Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL

The 150% FPL Penetration Ratio of Natural Gas Households

Average Heating Burden, Unsubsidized Households

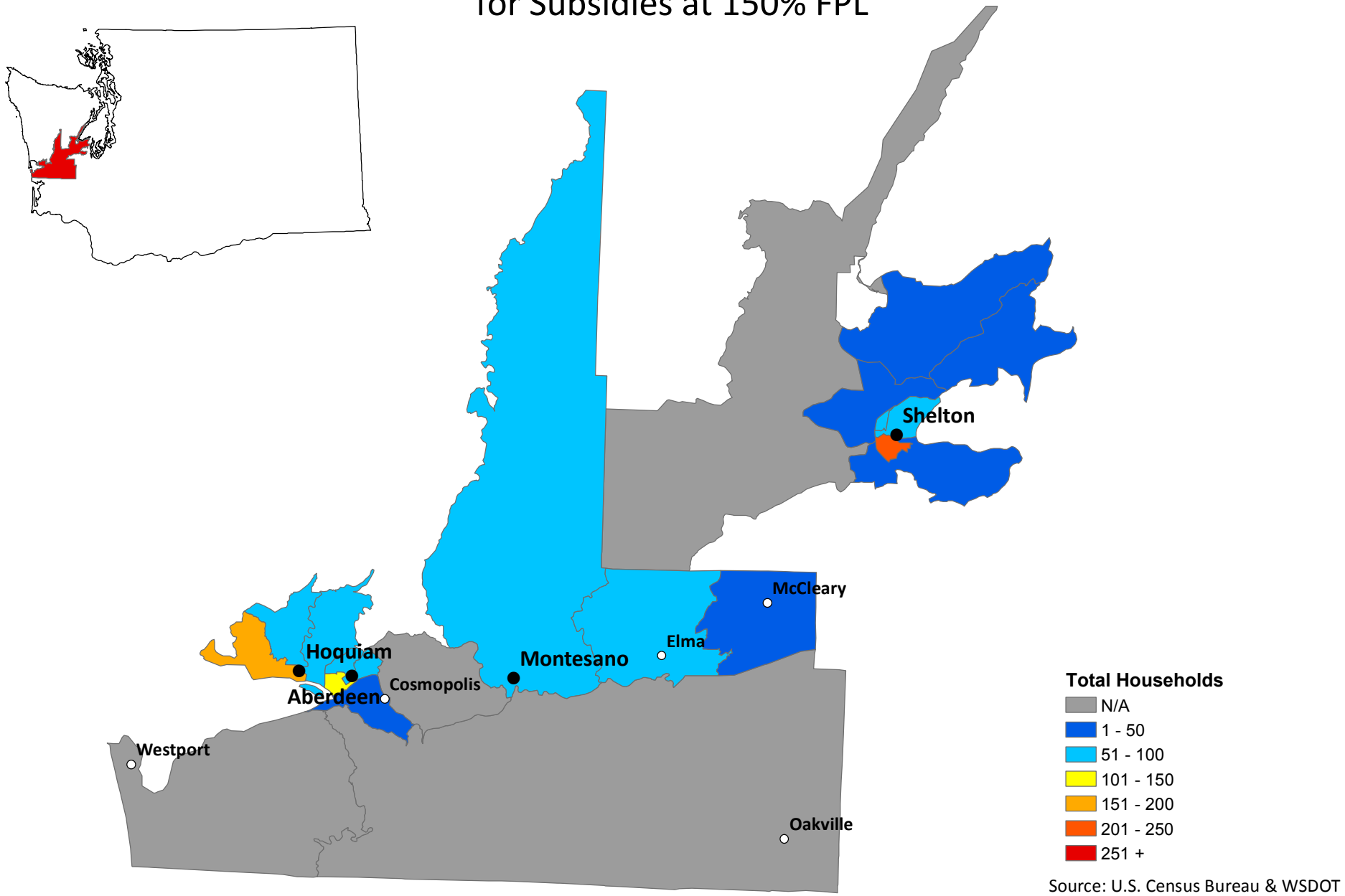
Average Heating Burden, Subsidized Households

Cascade Natural Gas Service Districts in Washington State



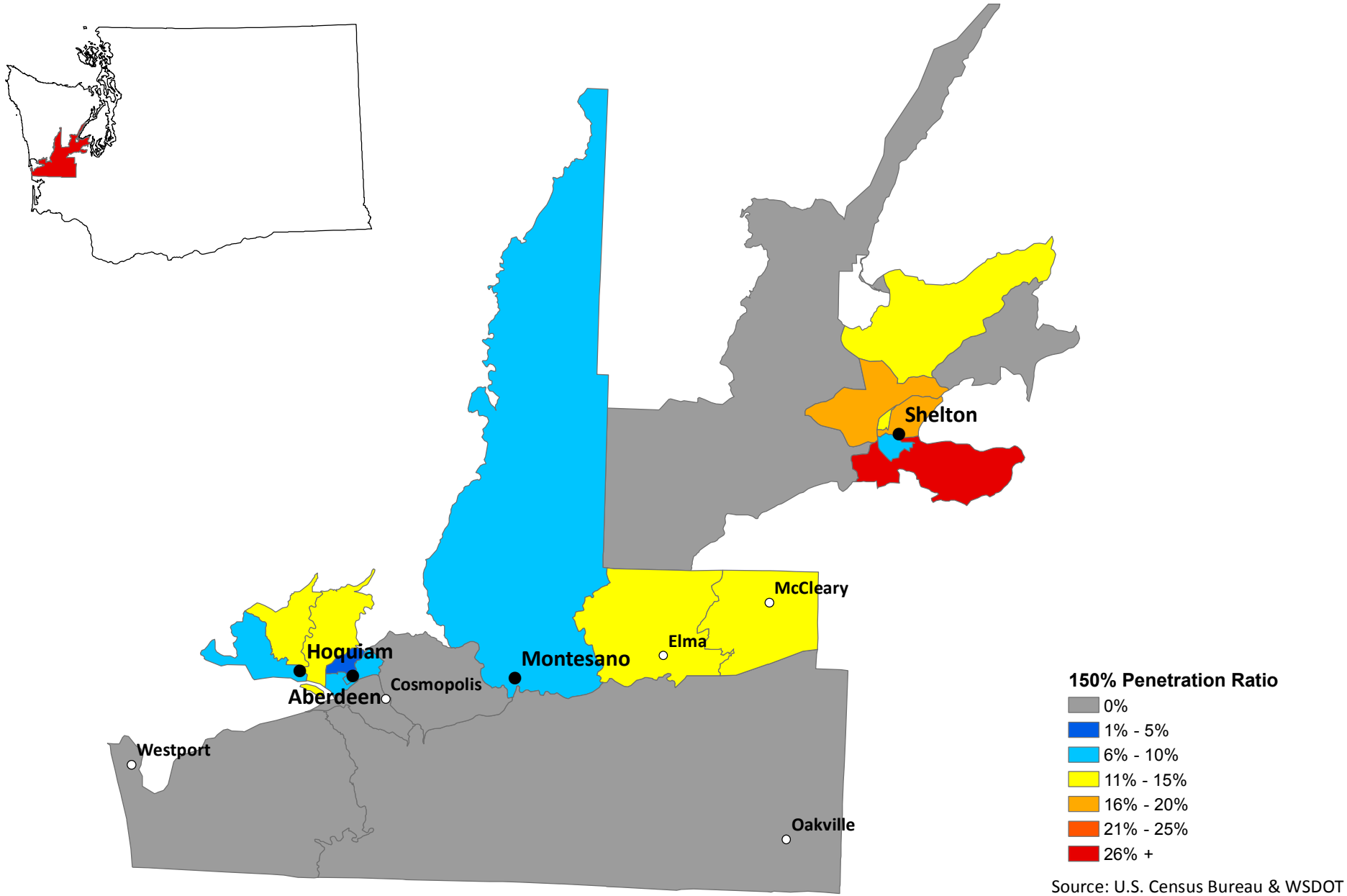
Source: U.S. Census Bureau

Aberdeen District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



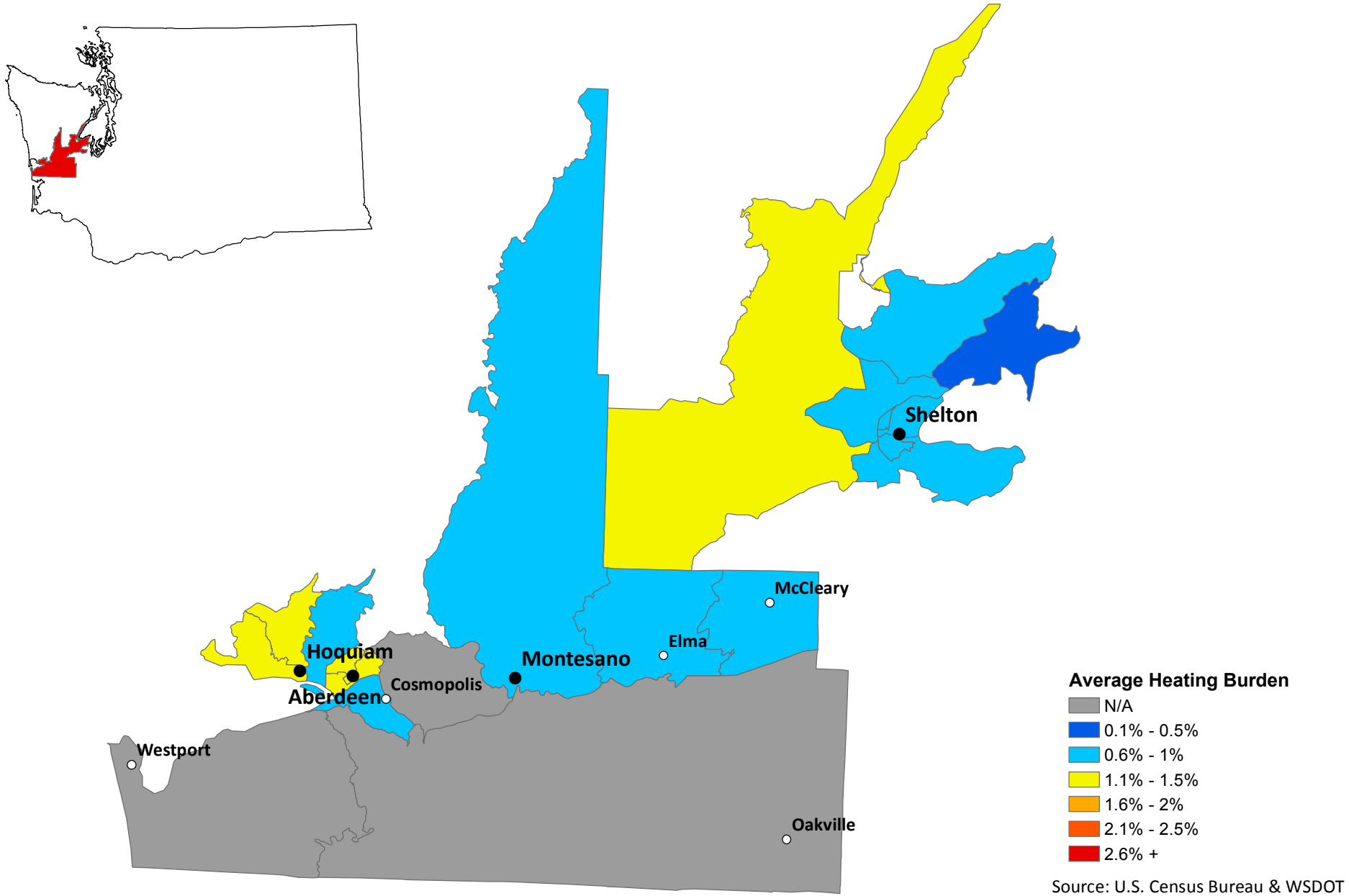
Source: U.S. Census Bureau & WSDOT

Aberdeen District: The 150% Penetration Ratio of Natural Gas Households



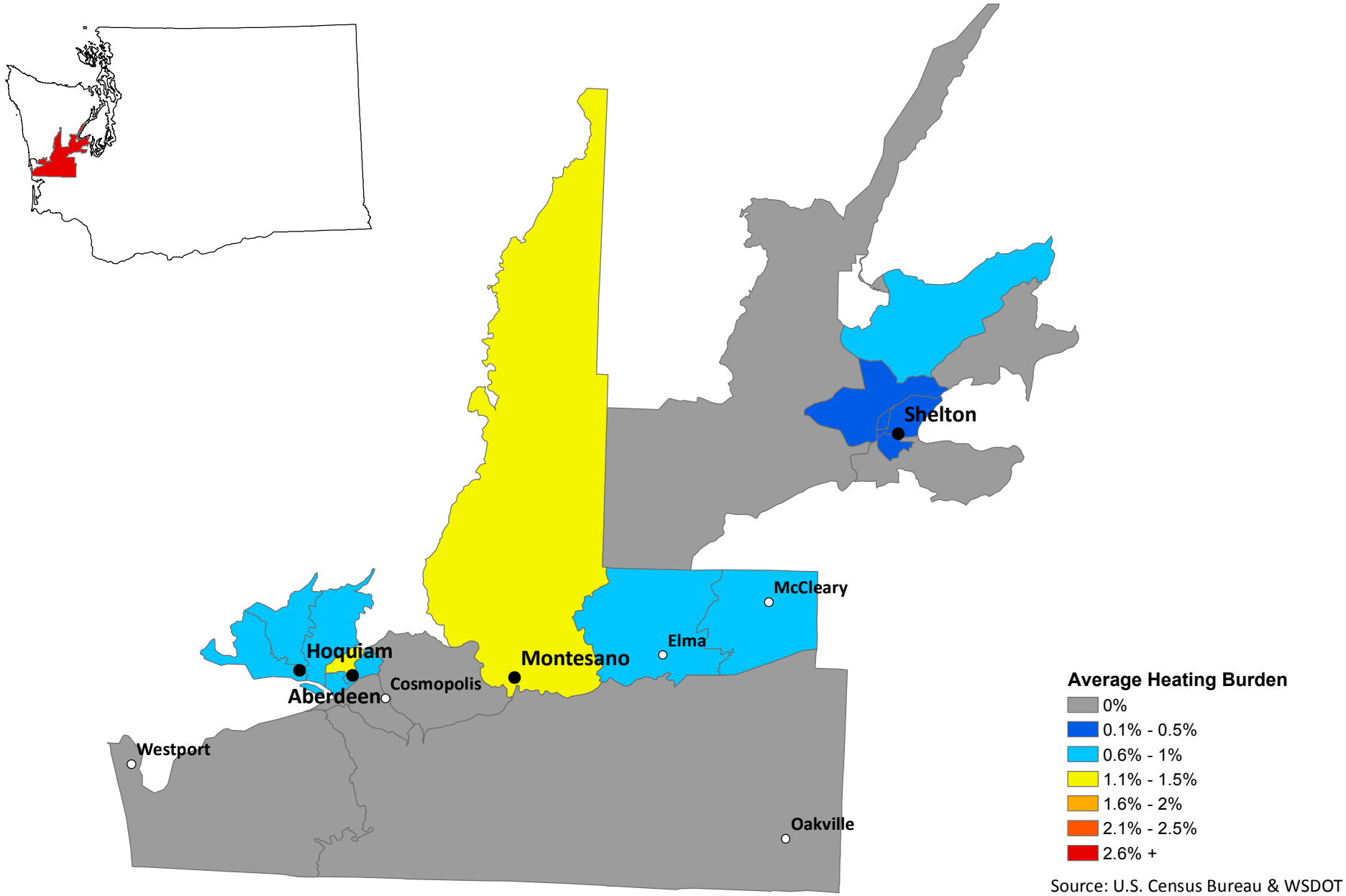
Source: U.S. Census Bureau & WSDOT

Aberdeen District: Average Heating Burden, Unsubsidized Households



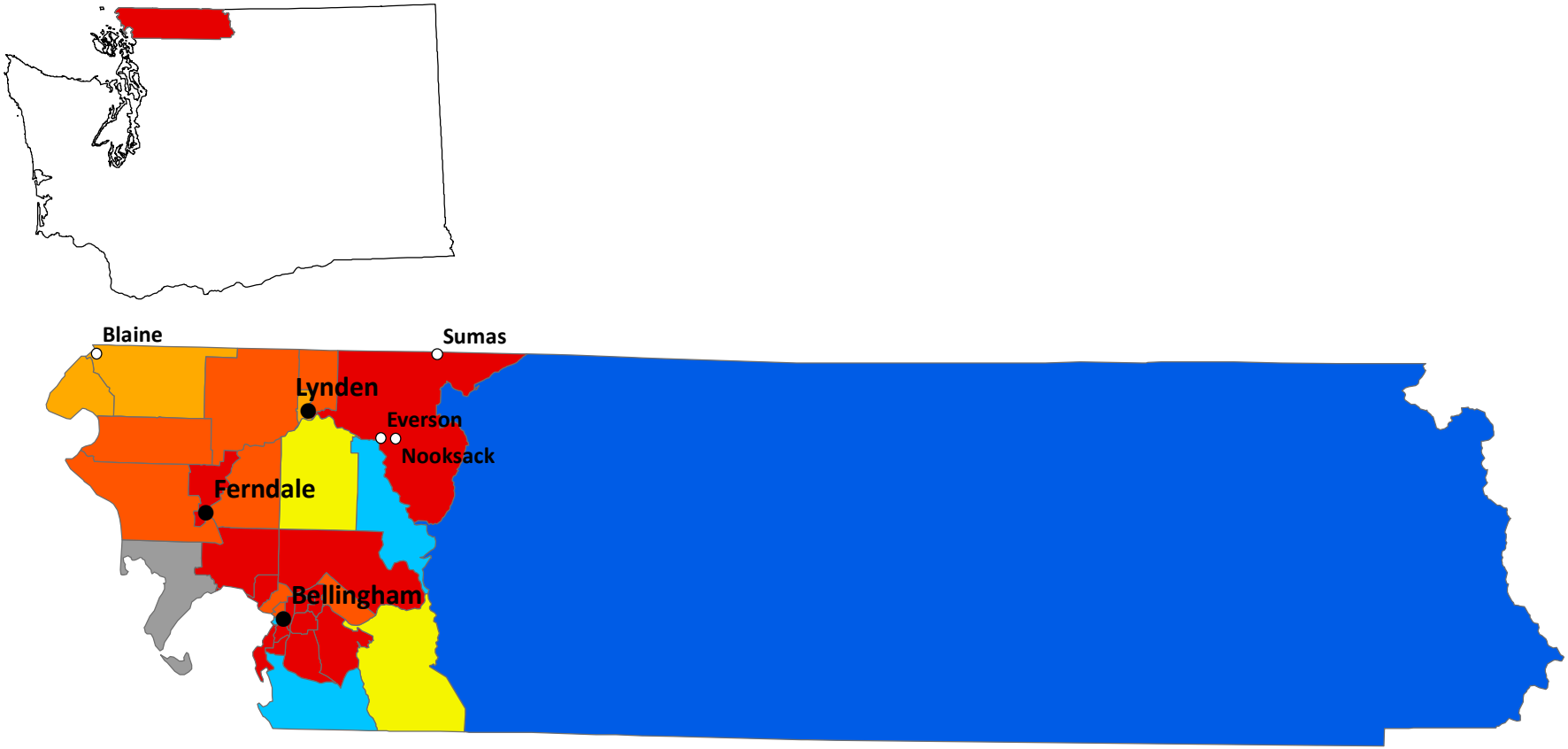
Source: U.S. Census Bureau & WSDOT

Aberdeen District: Average Heating Burden, Subsidized Households



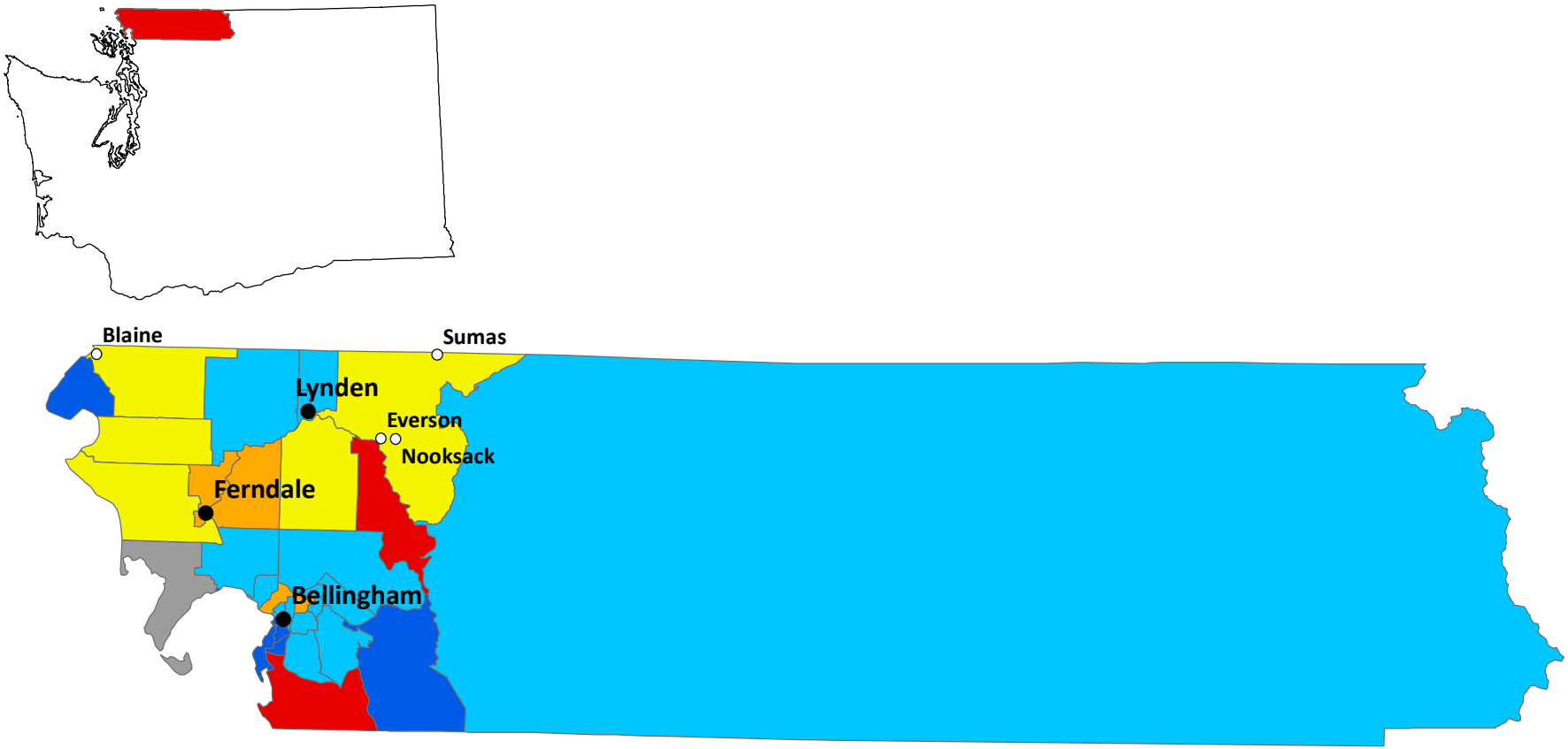
Source: U.S. Census Bureau & WSDOT

Bellingham District: Number of Households Using Natural Gas that Qualifty for Subsidies at 150% FPL



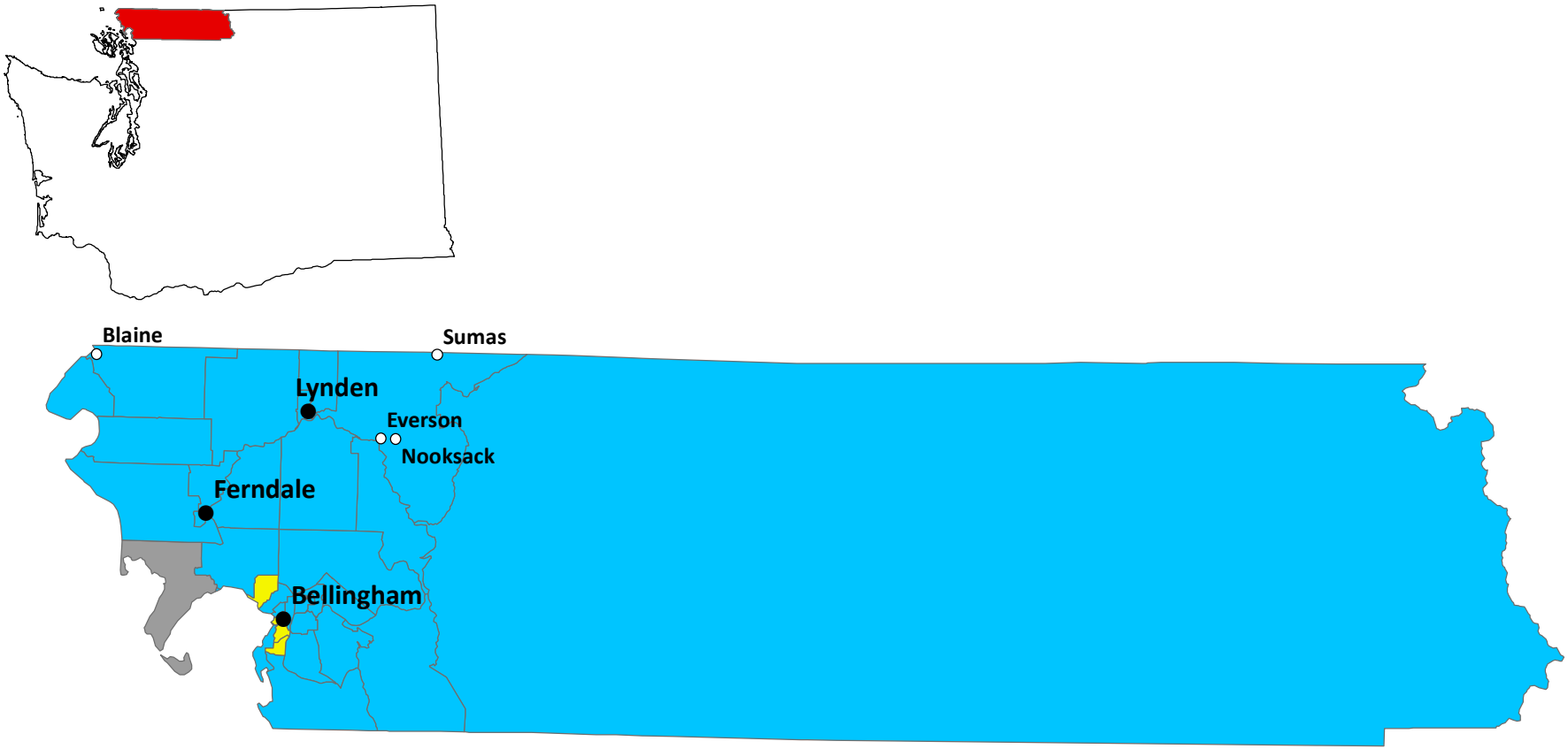
Source: U.S. Census Bureau & WSDOT

Bellingham District: The 150% Penetration Ratio of Natural Gas Households



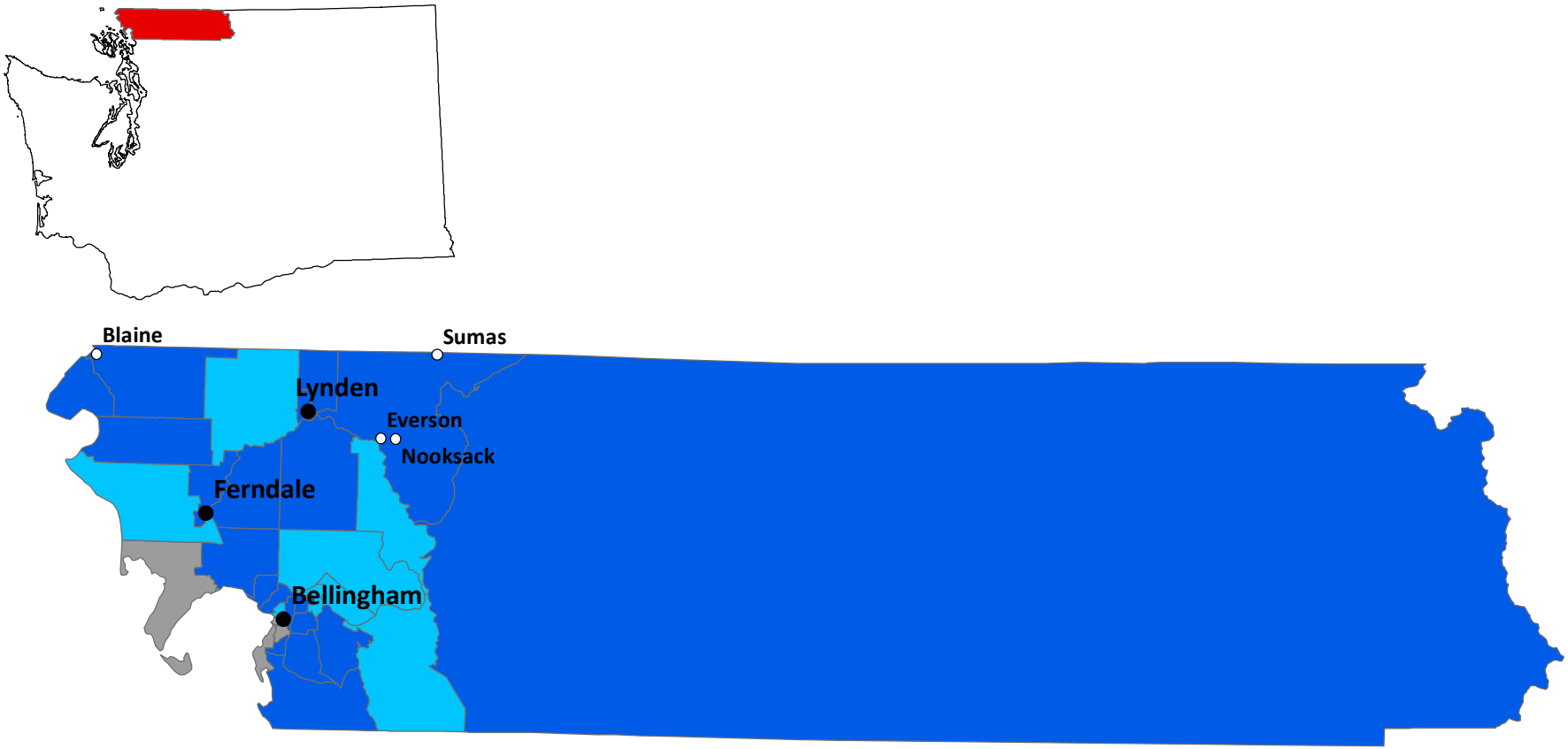
Source: U.S. Census Bureau & WSDOT

Bellingham District: Average Heating Burden, Unsubsidized Households



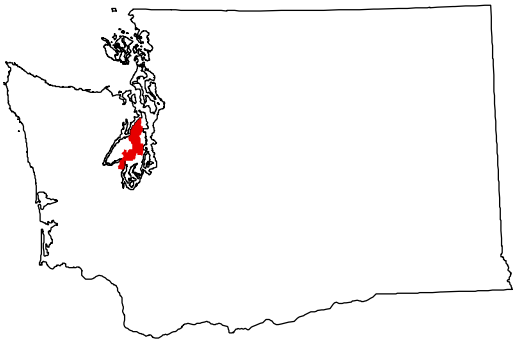
Source: U.S. Census Bureau & WSDOT

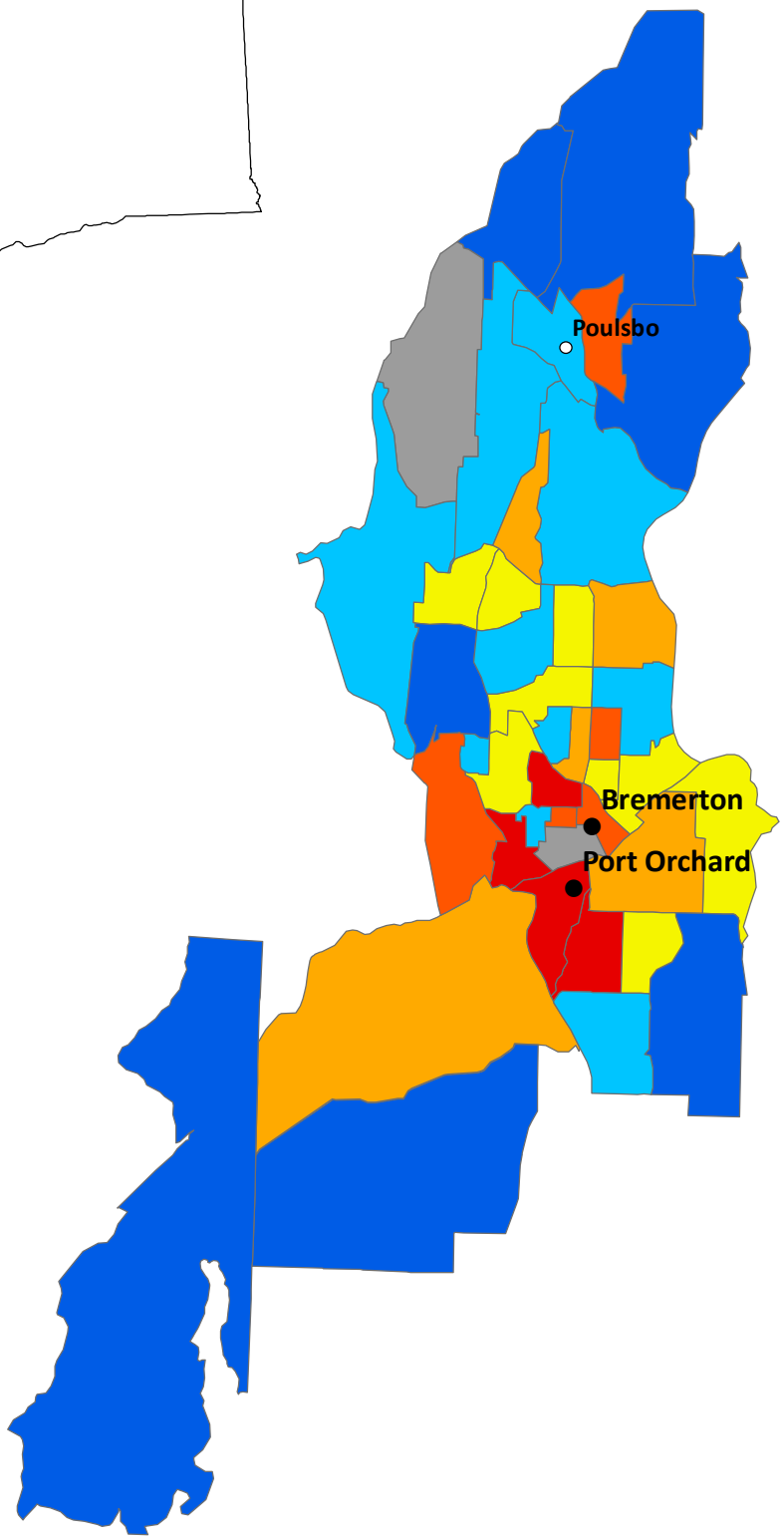
Bellingham District: Average Heating Burden, Subsidized Households



Source: U.S. Census Bureau & WSDOT

Bremerton District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



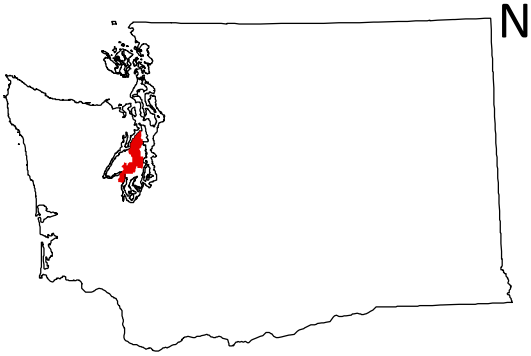


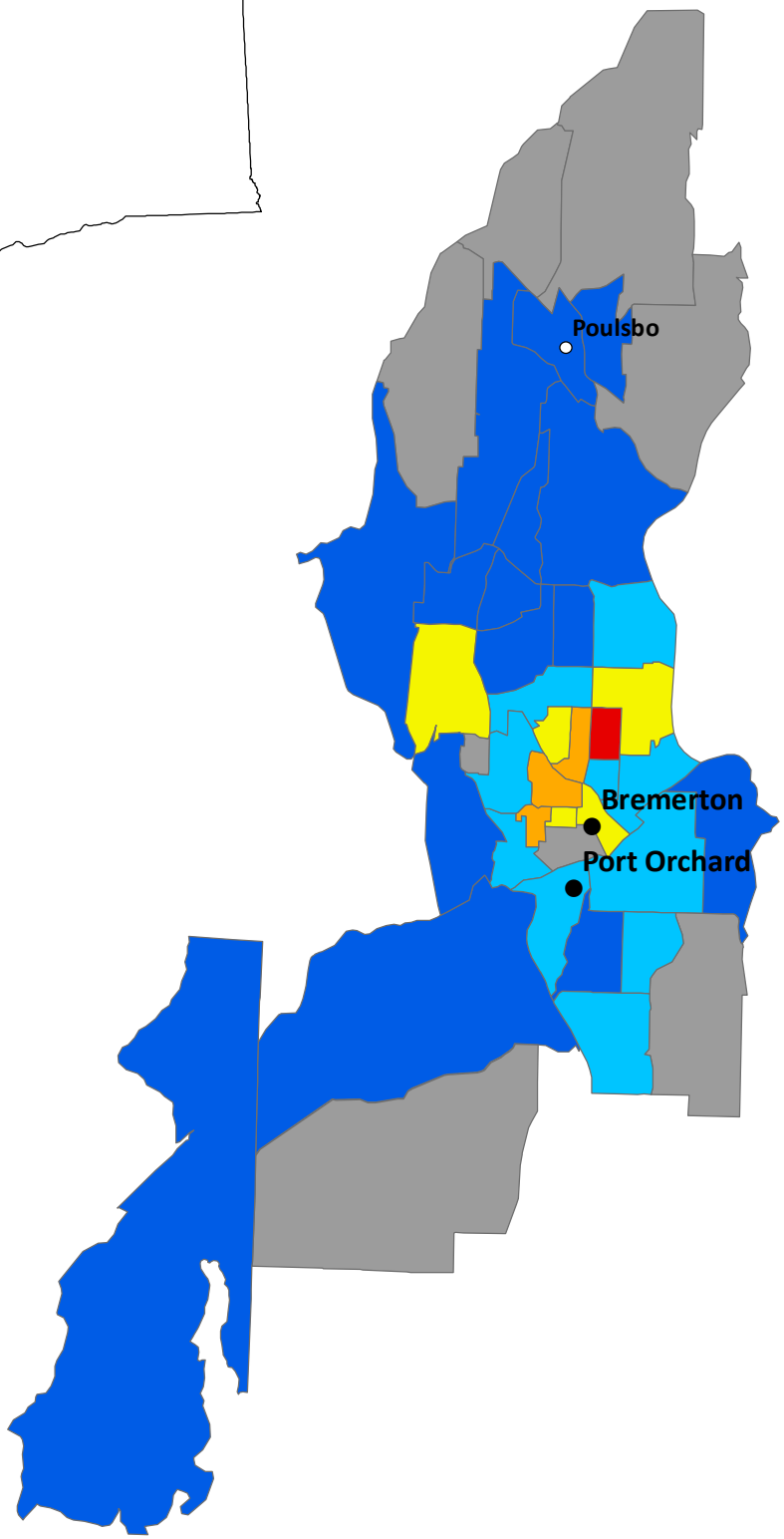
Total Households

- N/A
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 +

Source: U.S. Census Bureau & WSDOT

Bremerton District: The 150% Penetration Ratio of Natural Gas Households



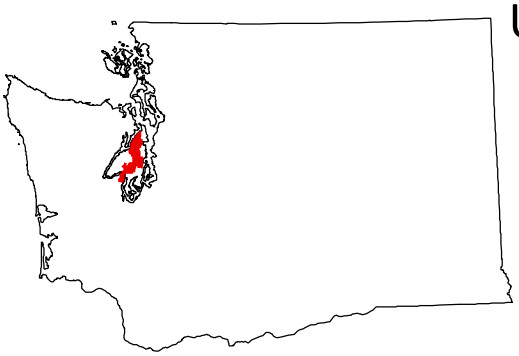


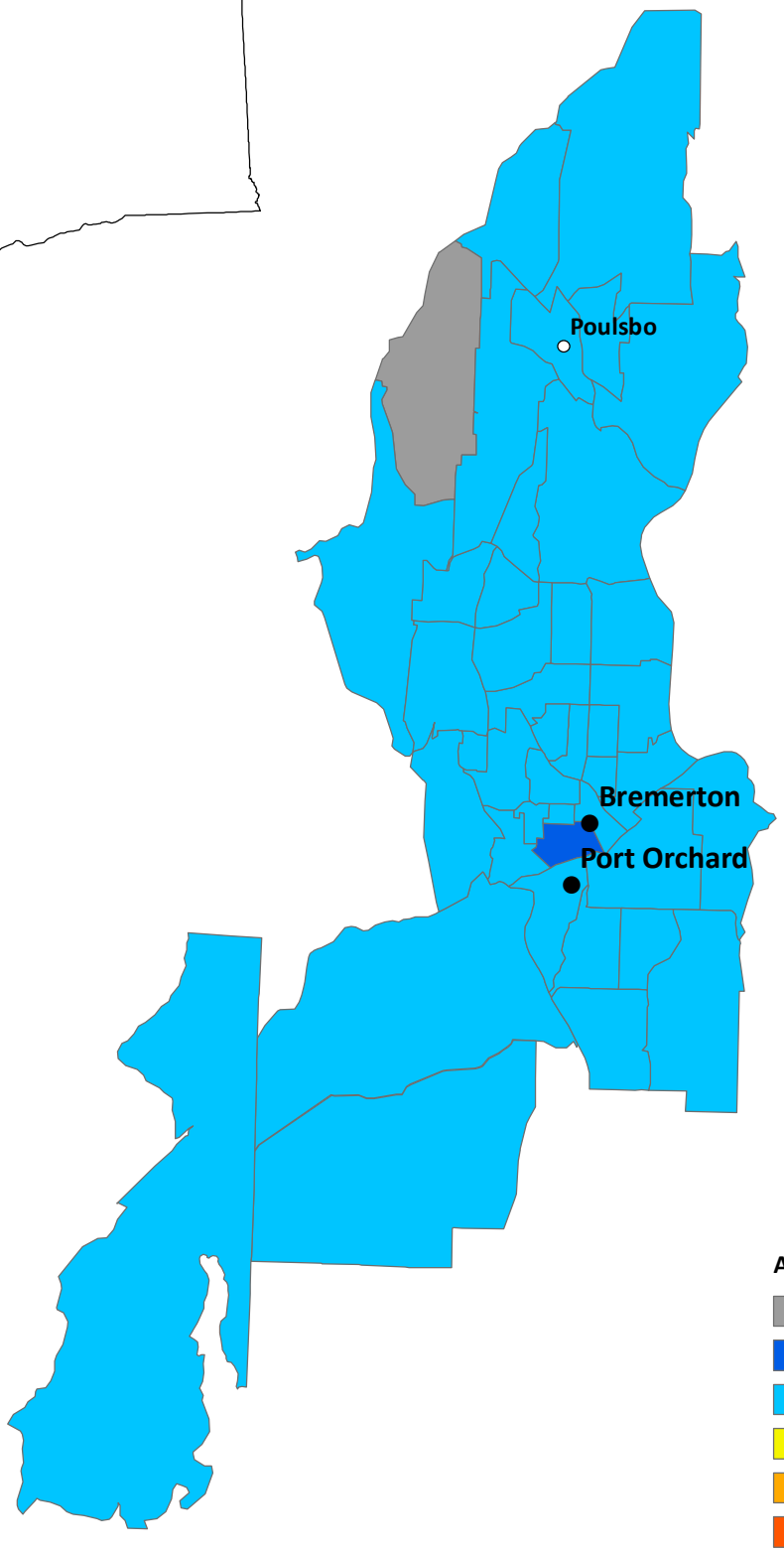
150% Penetration Ratio

- N/A
- 1% - 5%
- 6% - 10%
- 11% - 15%
- 16% - 20%
- 21% - 25%
- 26% +

Source: U.S. Census Bureau & WSDOT

Bremerton District Average Heating Burden, Unsubsidized Households



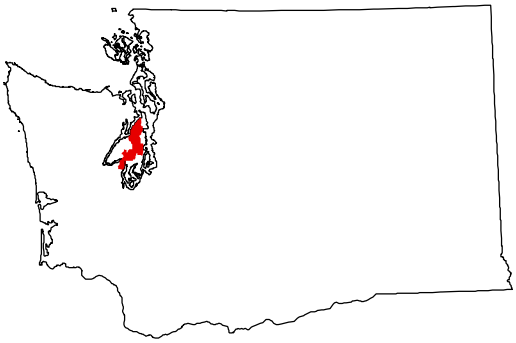


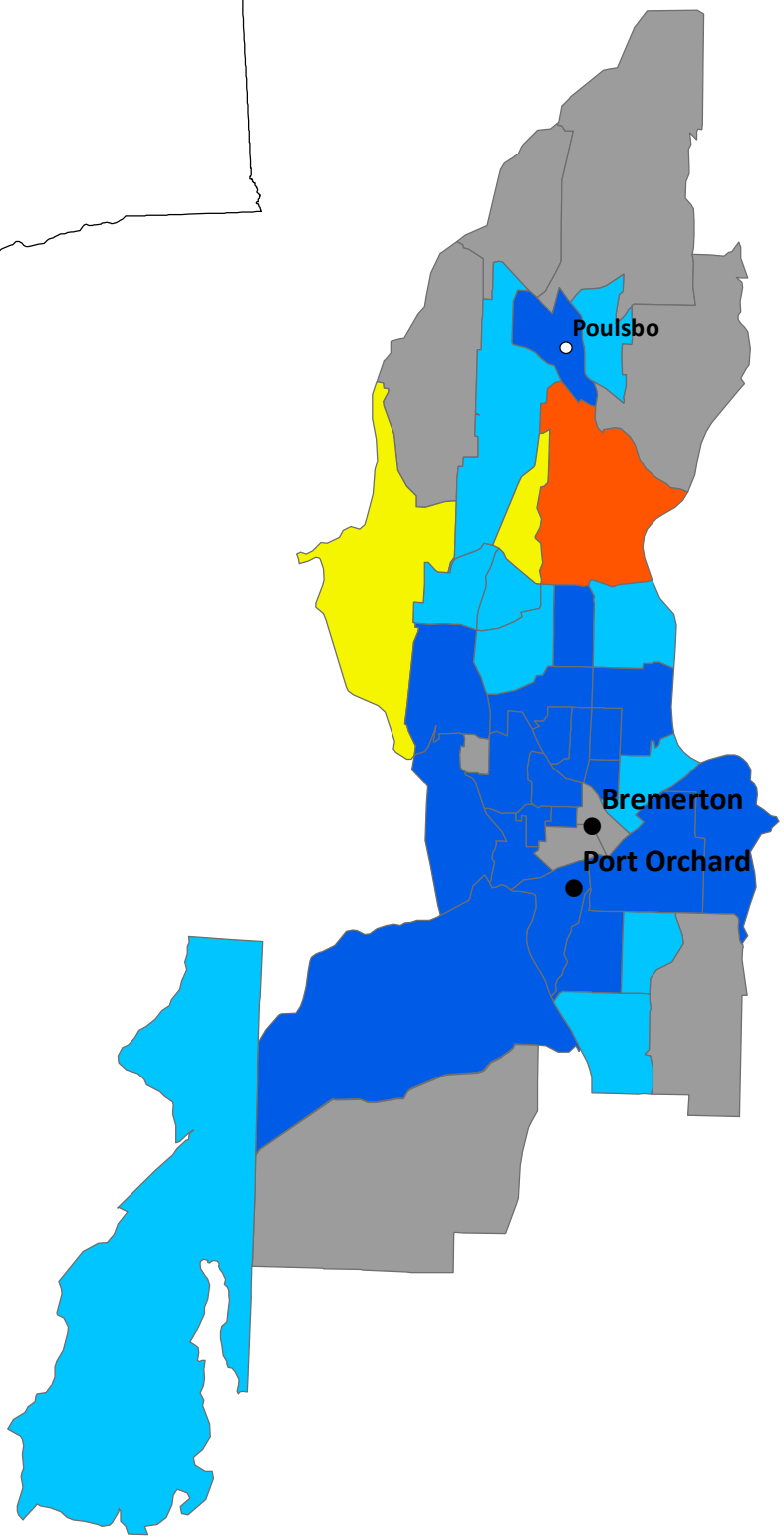
Average Heating Burden

- N/A
- 0.1% - 0.5%
- 0.6% - 1%
- 1.1% - 1.5%
- 1.6% - 2%
- 2.1% - 2.5%
- 2.6% +

Source: U.S. Census Bureau & WSDOT

Bremerton District: Average Heating Burden, Subsidized Households



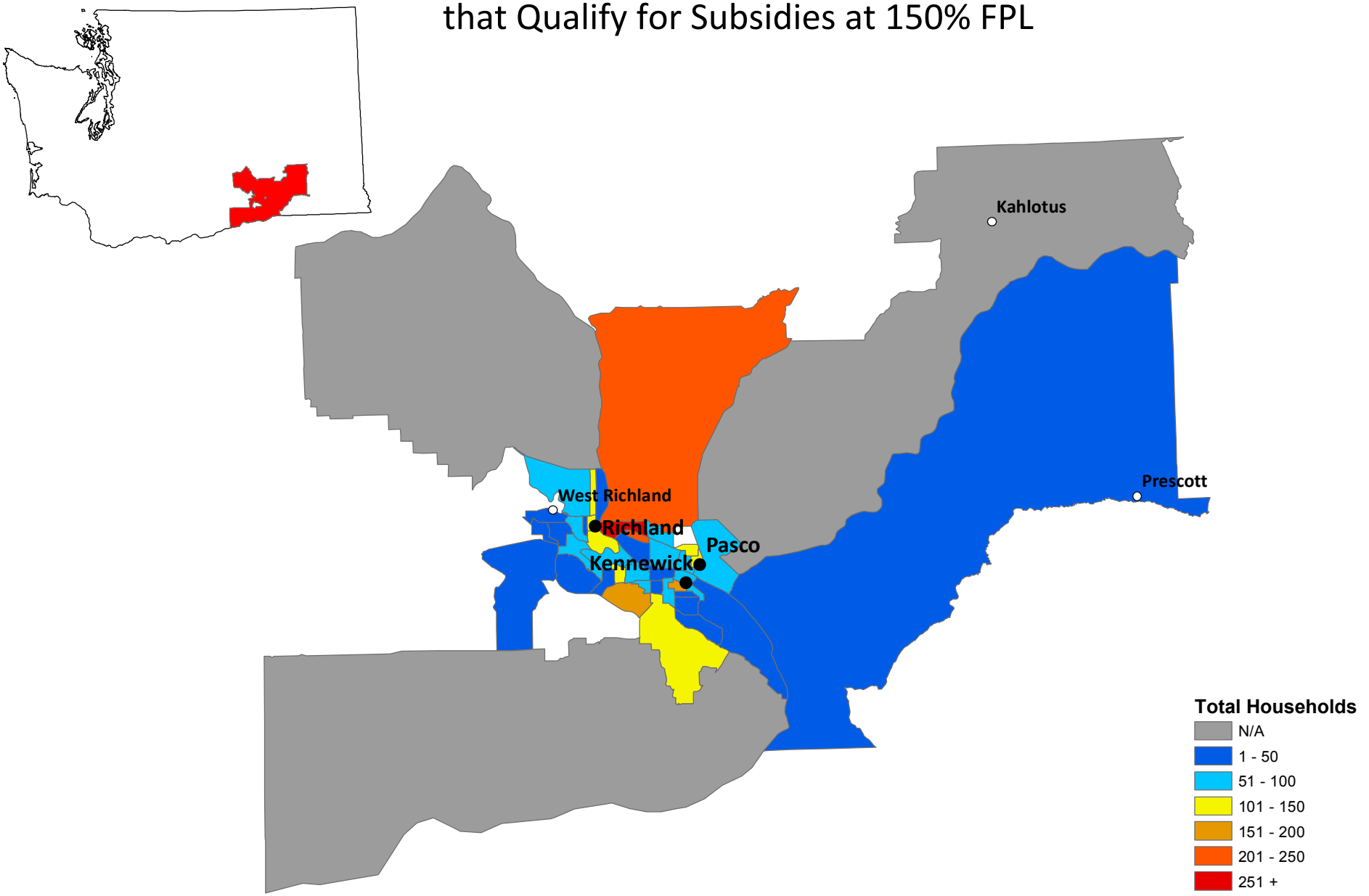


Average Heating Burden

- N/A
- 0.1% - 0.5%
- 0.6% - 1%
- 1.1% - 1.5%
- 1.6% - 2%
- 2.1% - 2.5%
- 2.6% +

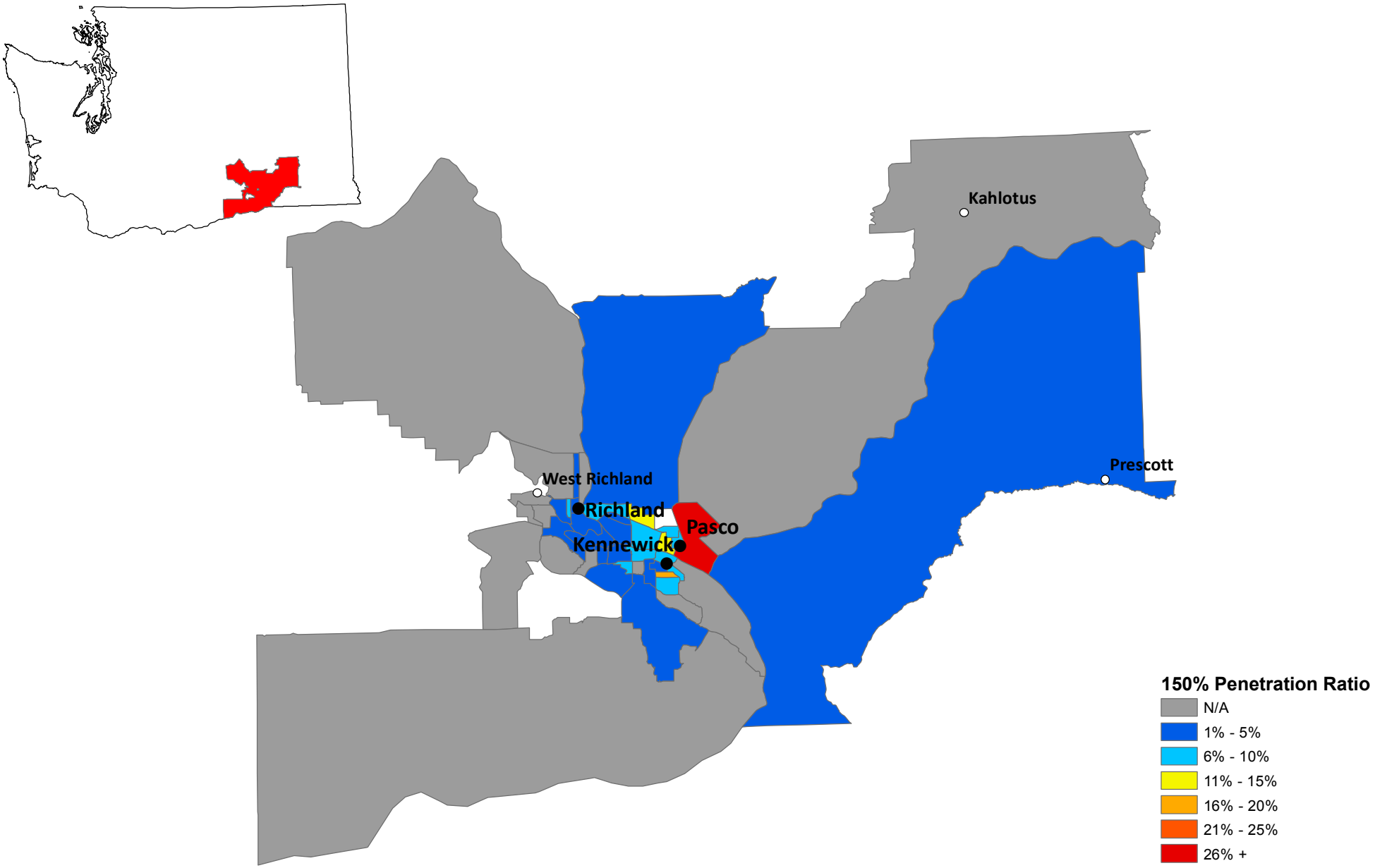
Source: U.S. Census Bureau & WSDOT

Kennewick District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



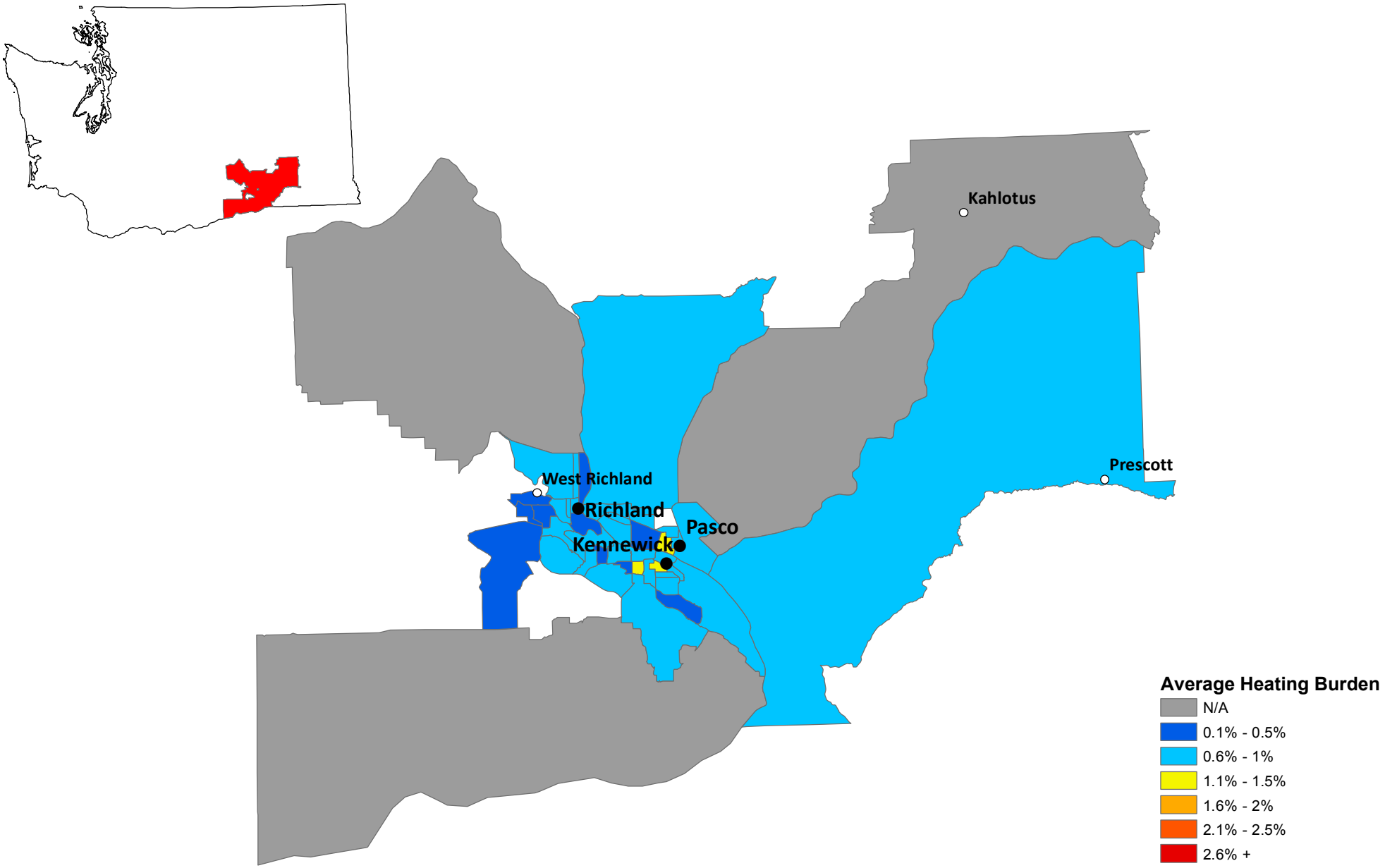
Source: U.S. Census Bureau & WSDOT

Kennewick District: The 150% Penetration Ratio of Natural Gas Households



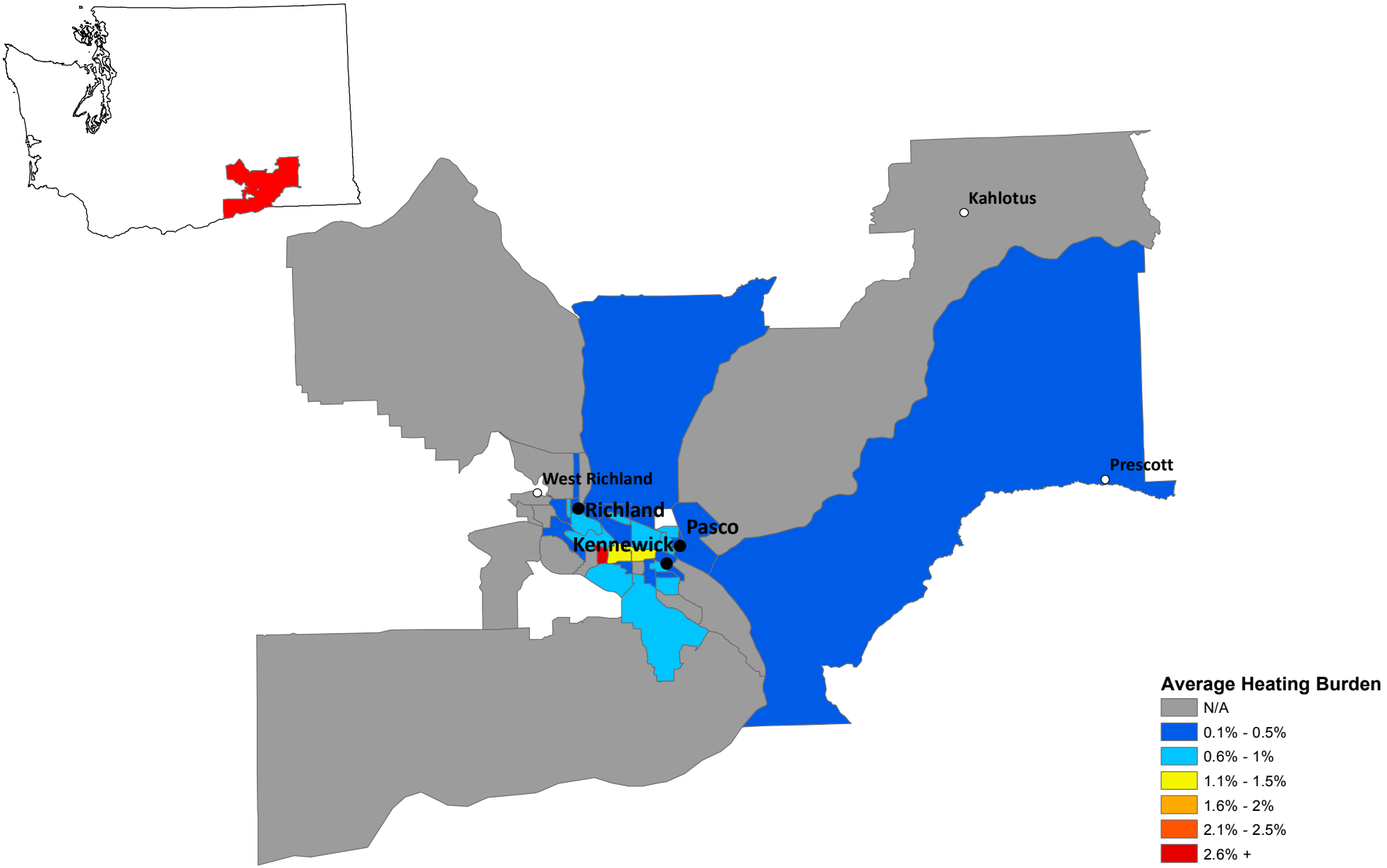
Source: U.S. Census Bureau & WSDOT

Kennewick District Average Heating Burden, Unsubsidized Households



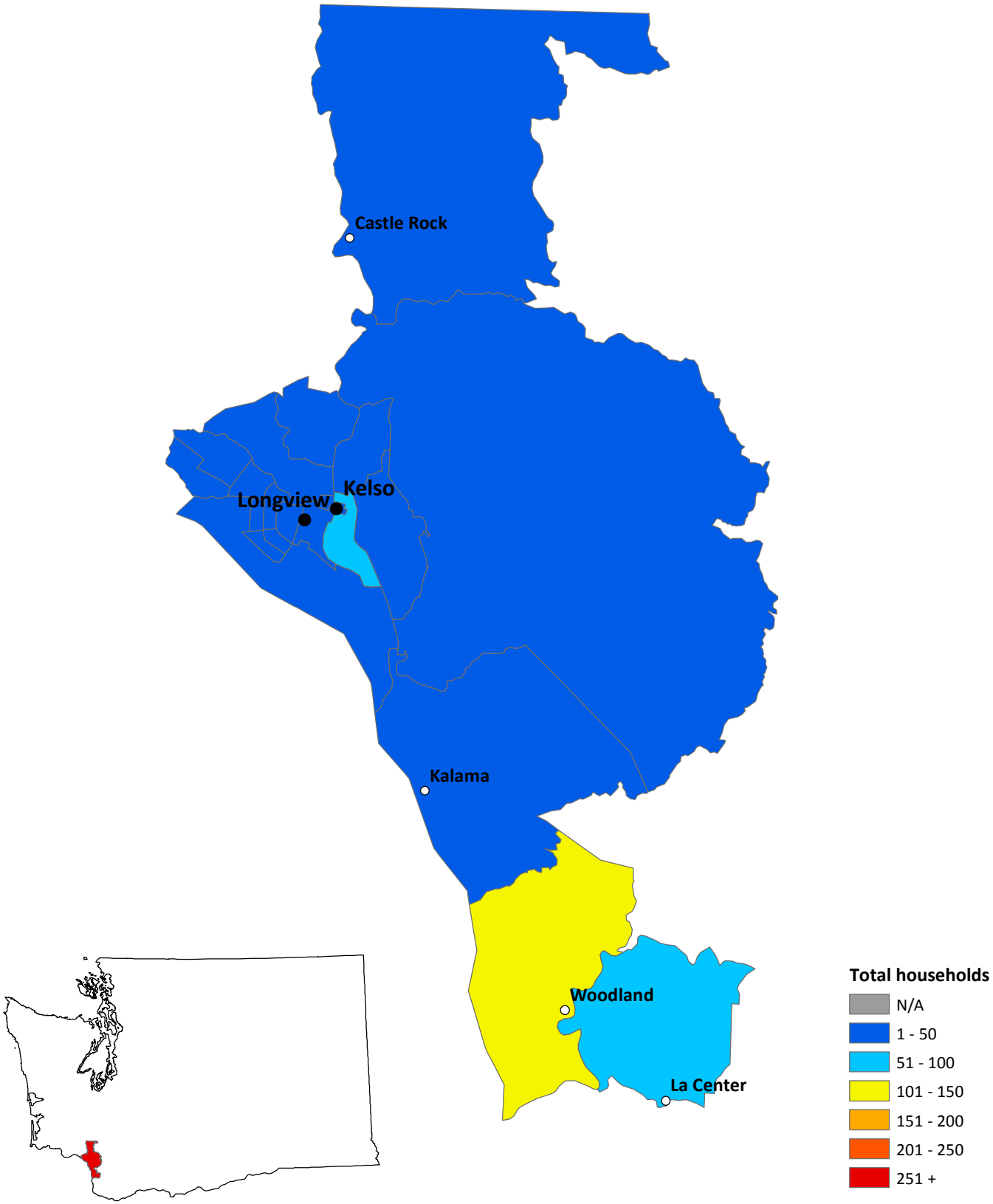
Source: U.S. Census Bureau & WSDOT

Kennewick District: Average Heating Burden, Subsidized Households



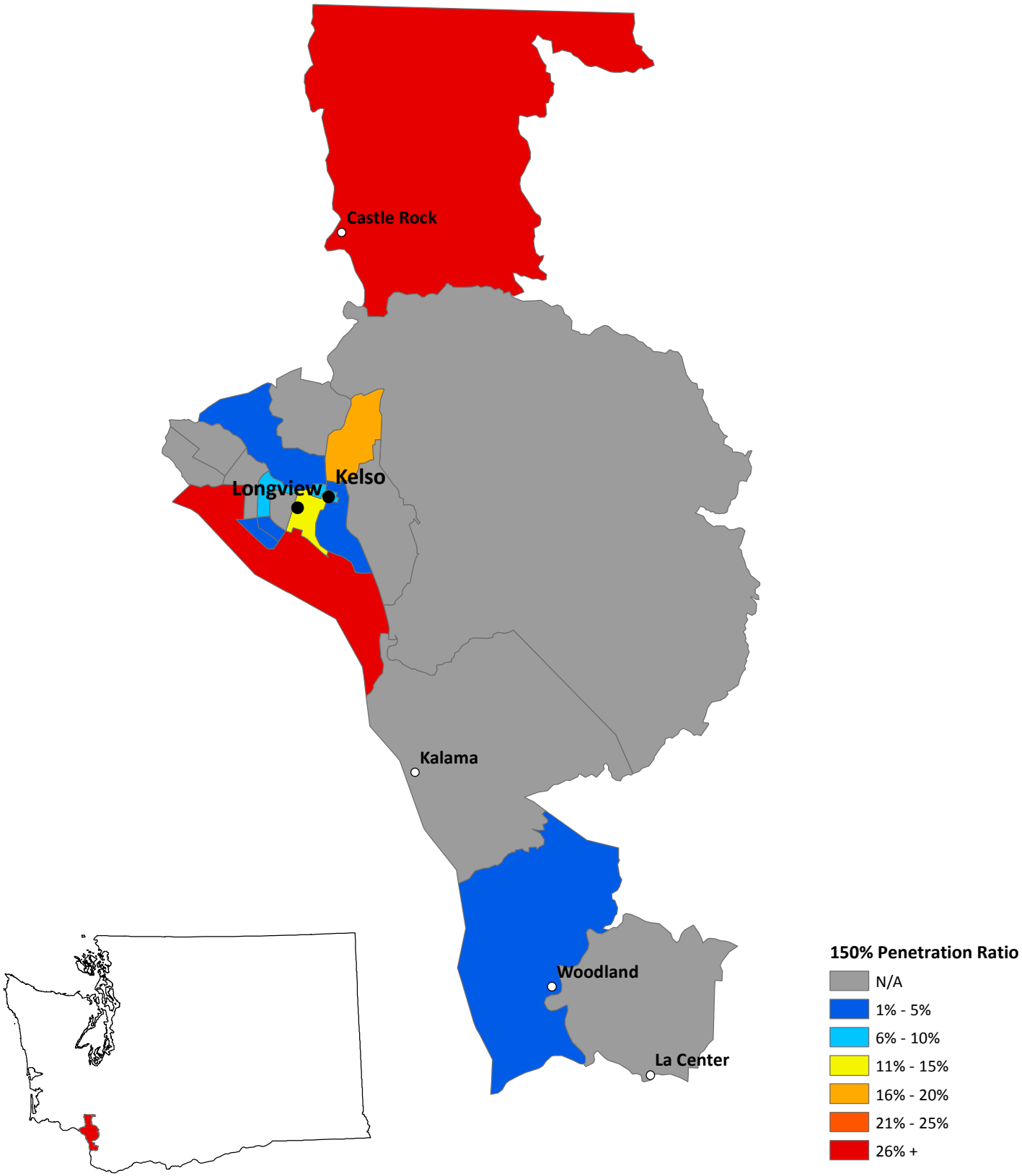
Source: U.S. Census Bureau & WSDOT

Longview District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



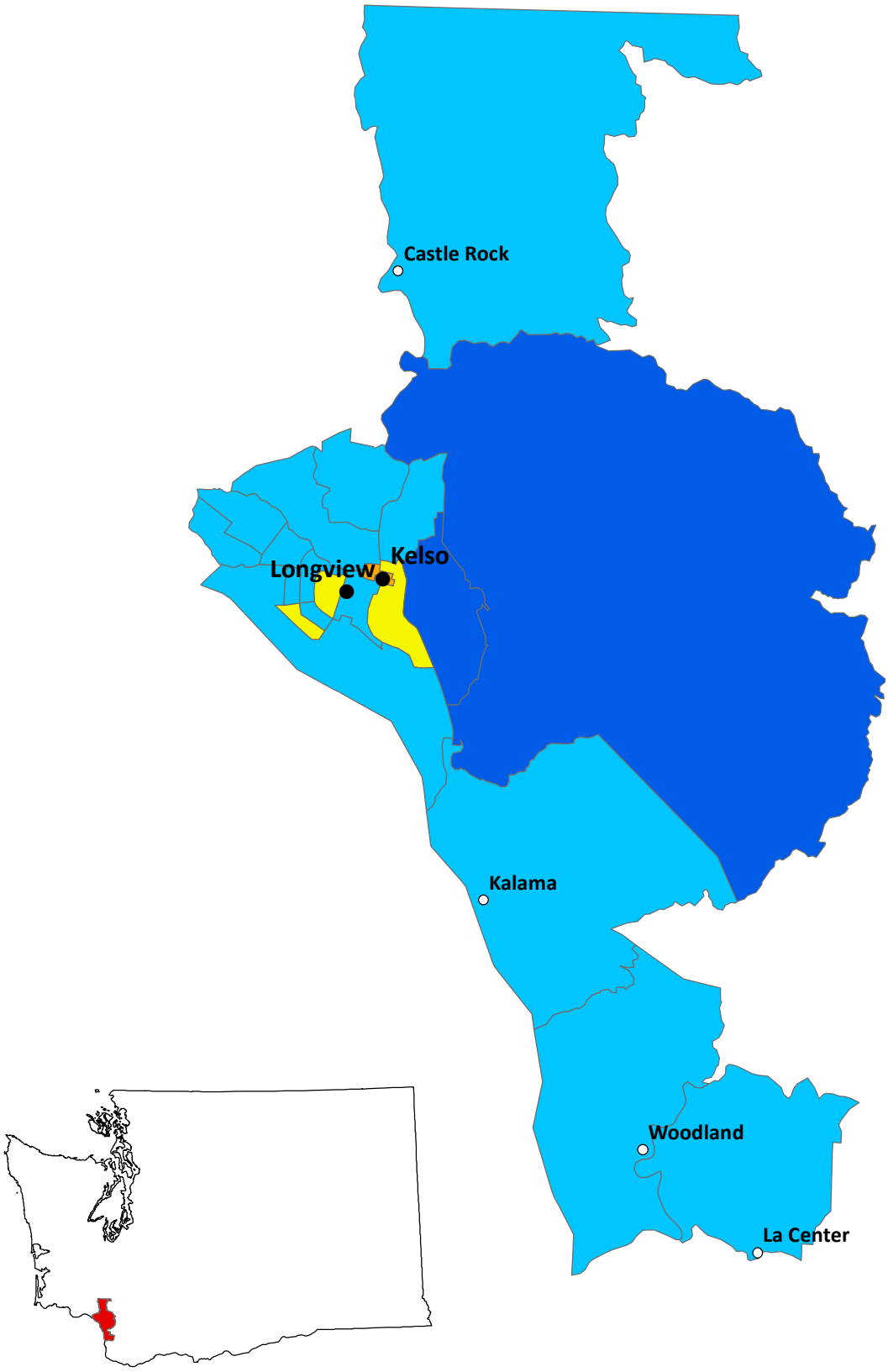
Source: U.S. Census Bureau & WSDOT

Longview District: The 150% Penetration Ratio of Natural Gas Households



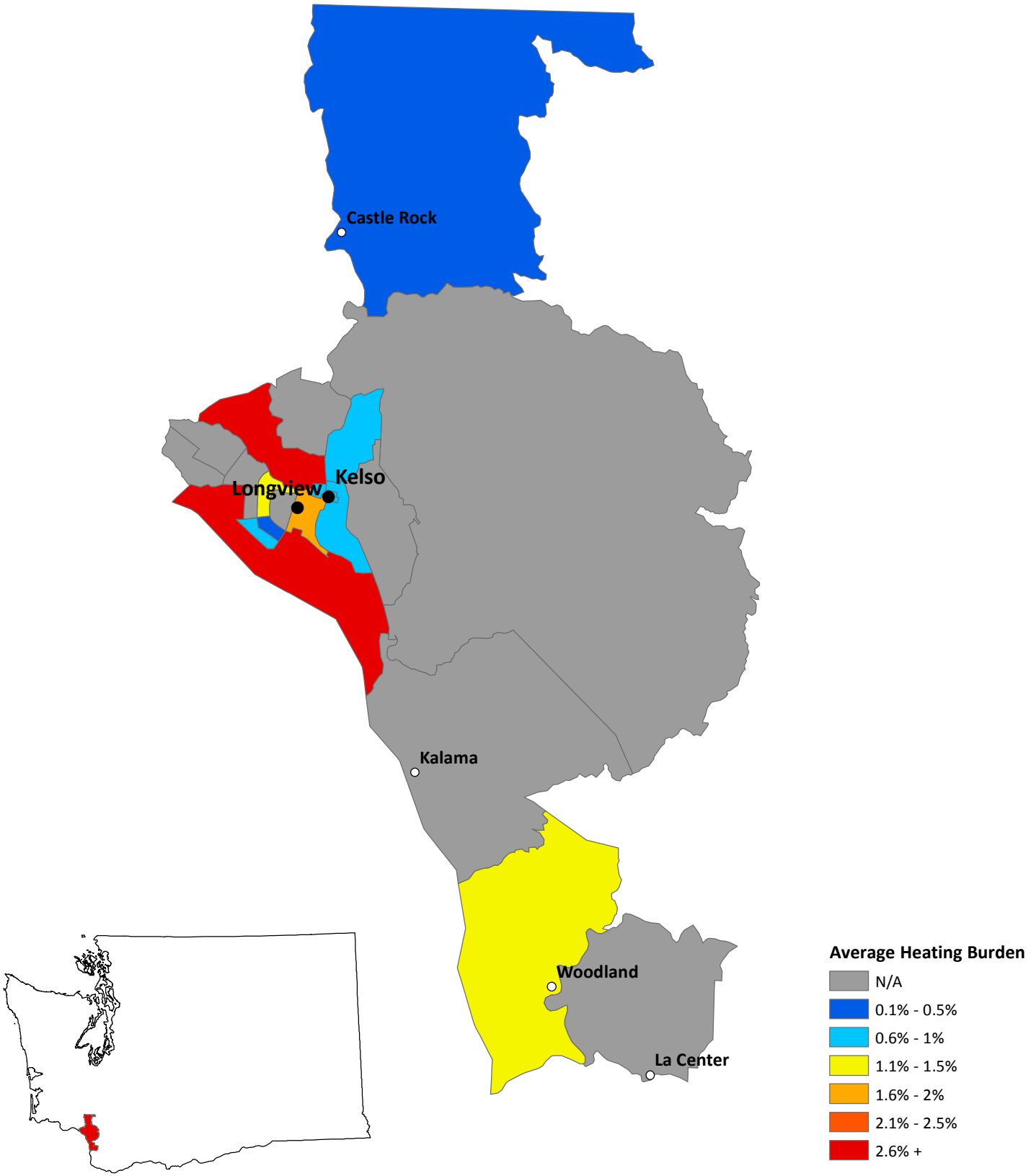
Source: U.S. Census Bureau & WSDOT

Longview District Average Heating Burden, Unsubsidized Households



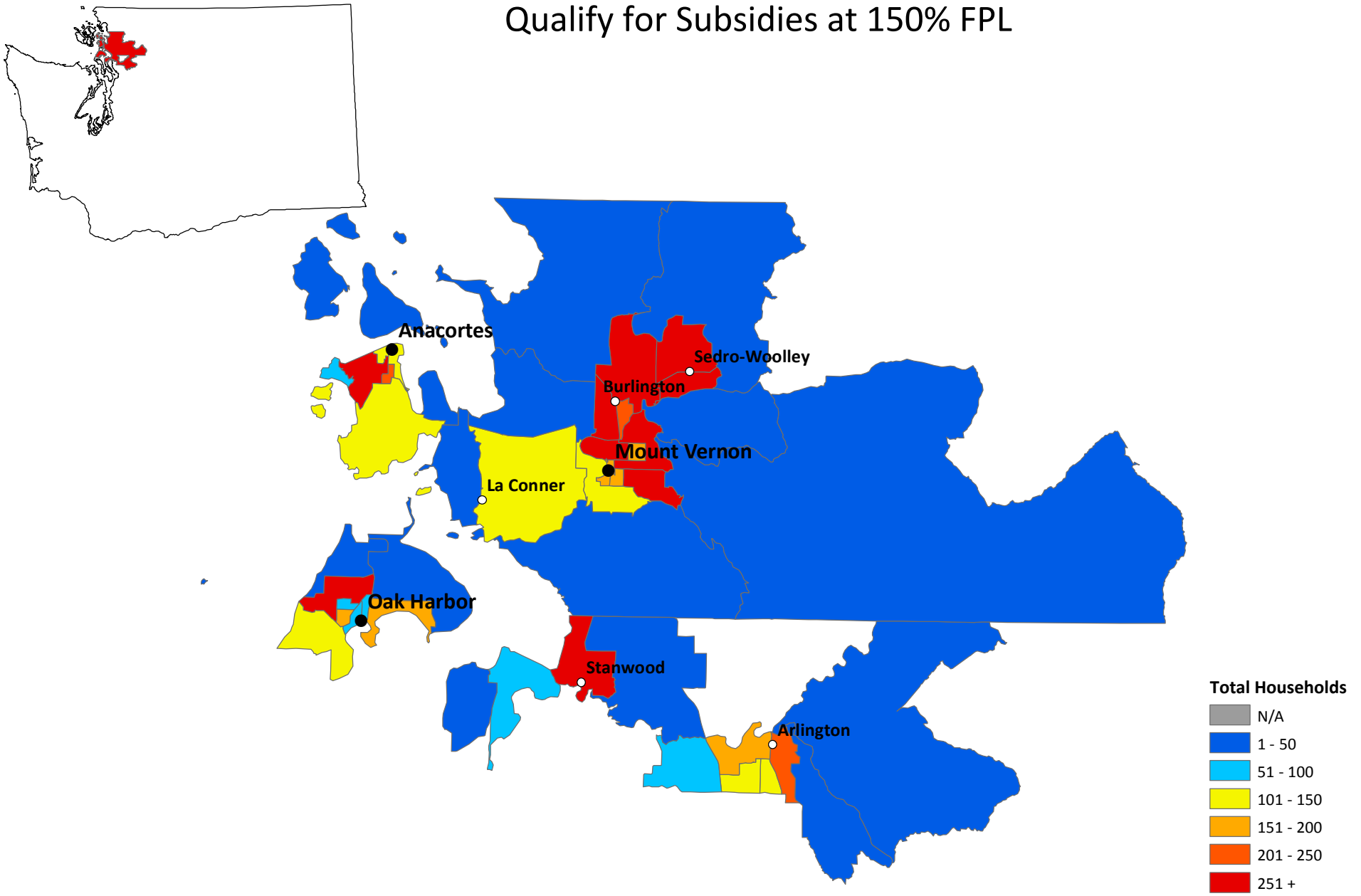
Source: U.S. Census Bureau & WSDOT

Longview District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



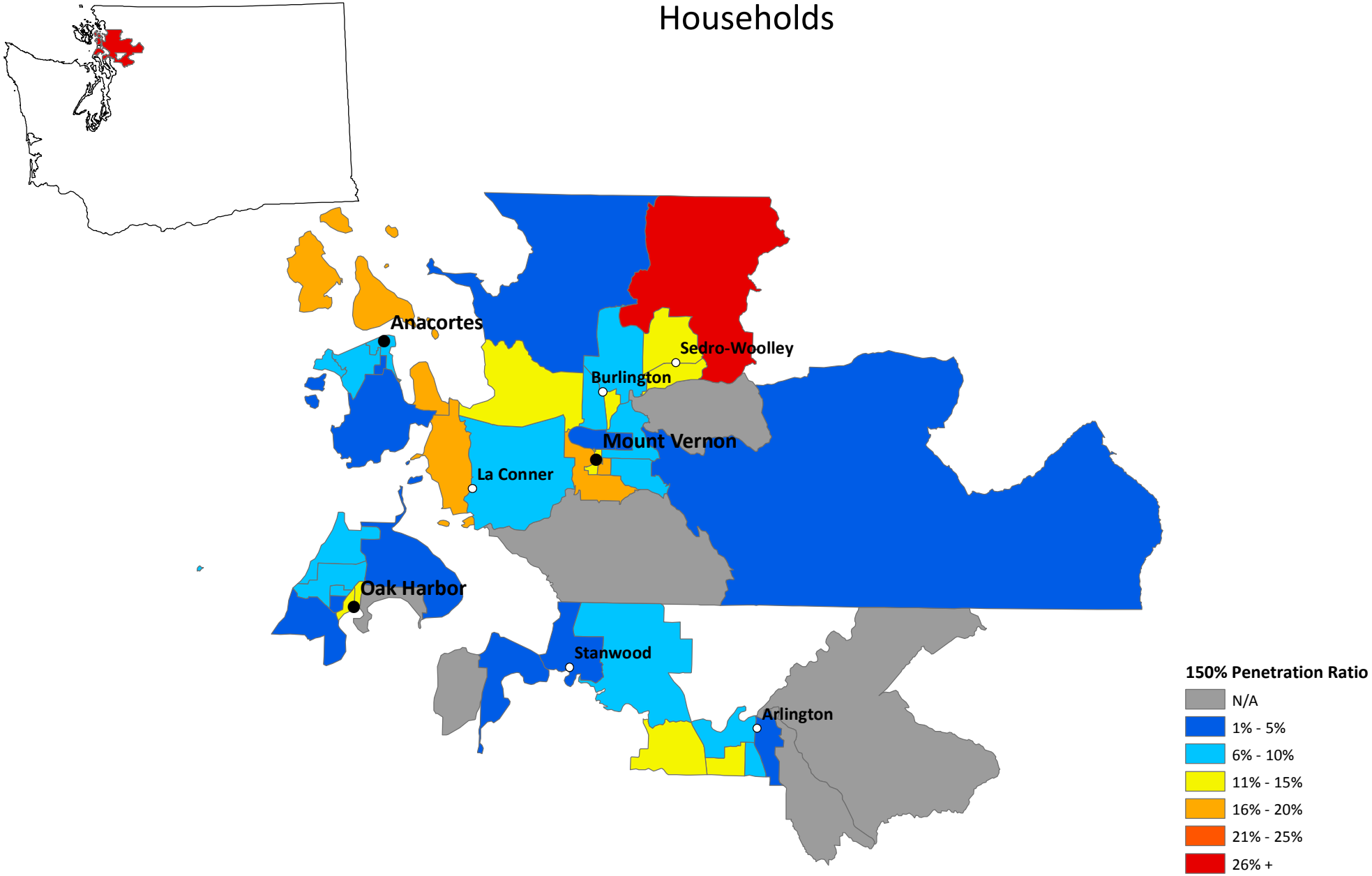
Source: U.S. Census Bureau & WSDOT

Mount Vernon District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



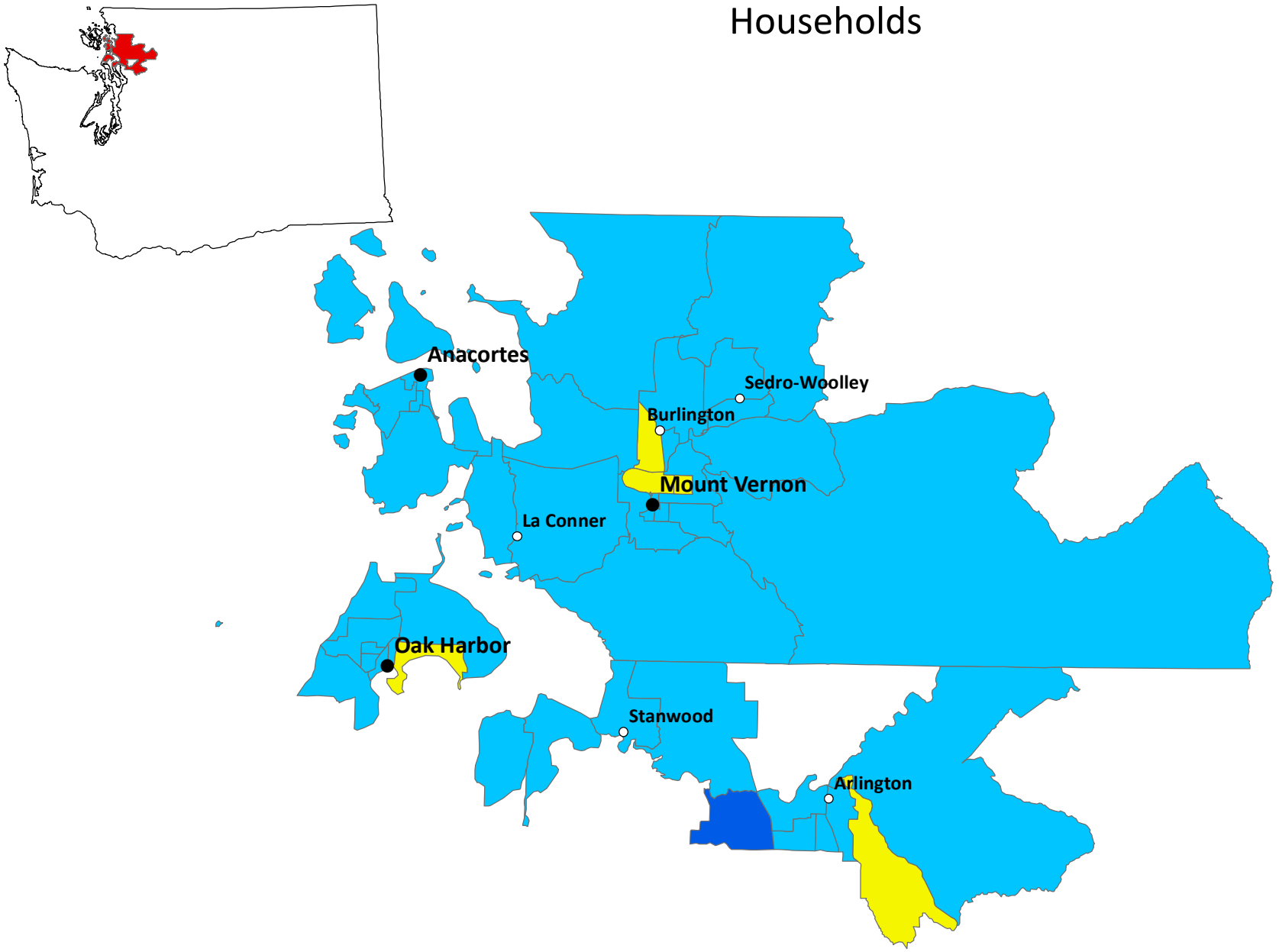
Source: U.S. Census Bureau & WSDOT

Mount Vernon District: The 150% Penetration Ratio of Natural Gas Households



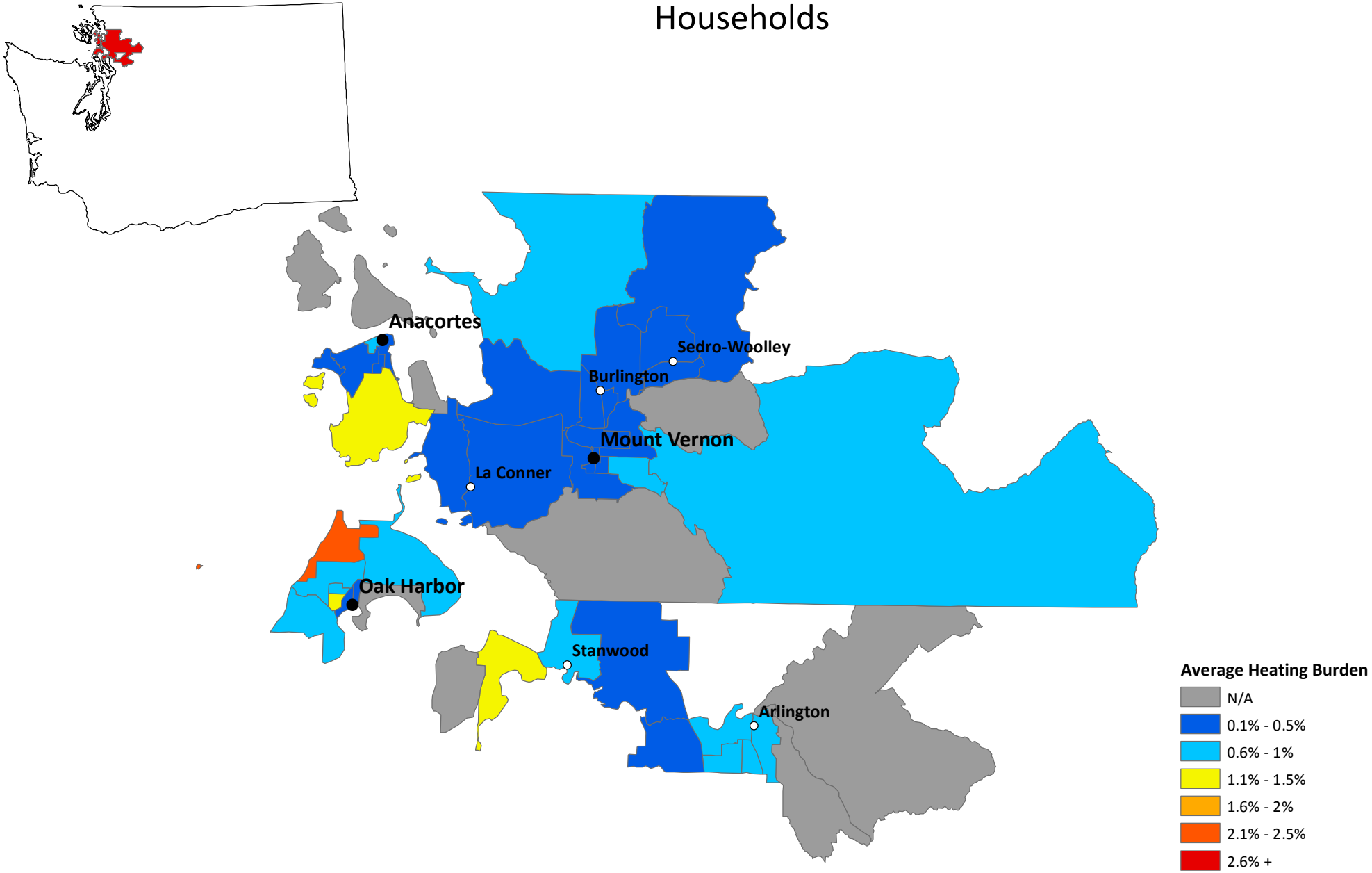
Source: U.S. Census Bureau & WSDOT

Mount Vernon District Average Heating Burden, Unsubsidized Households



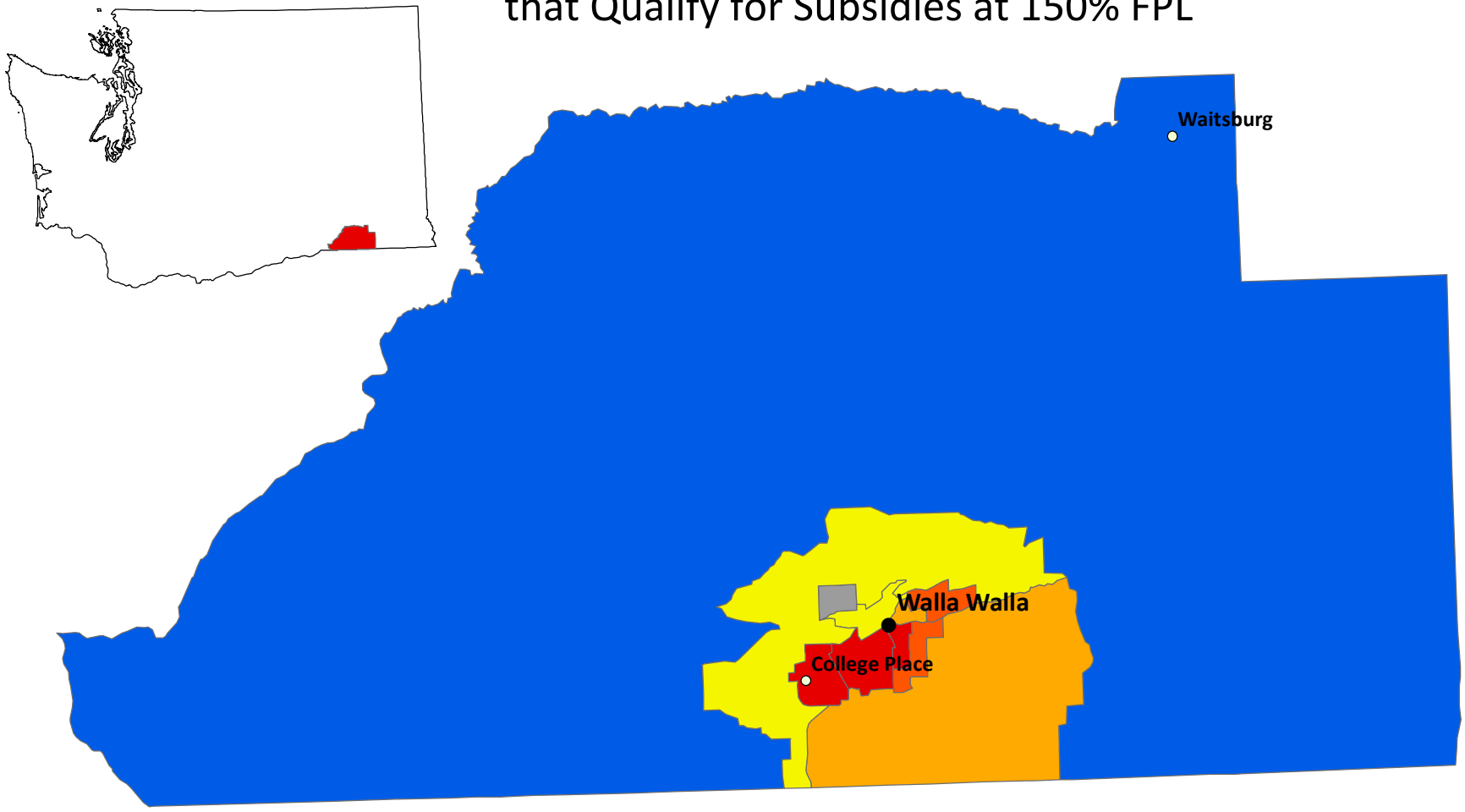
Source: U.S. Census Bureau & WSDOT

Mount Vernon District: Average Heating Burden, Subsidized Households



Source: U.S. Census Bureau & WSDOT

Walla Walla District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL

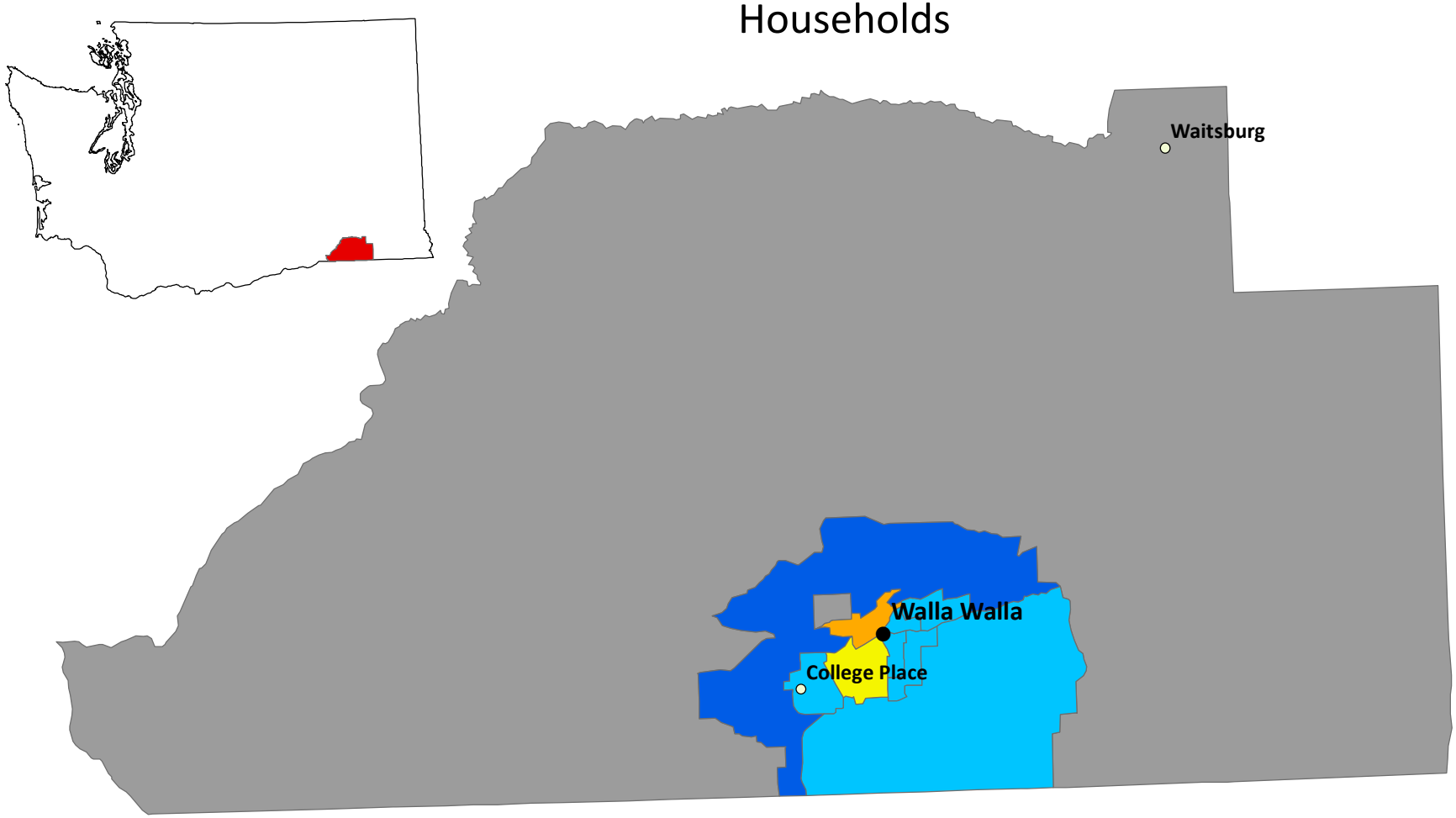


Total Households

- N/A
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 +

Source: U.S. Census Bureau & WSDOT

Walla Walla District: The 150% Penetration Ratio of Natural Gas Households

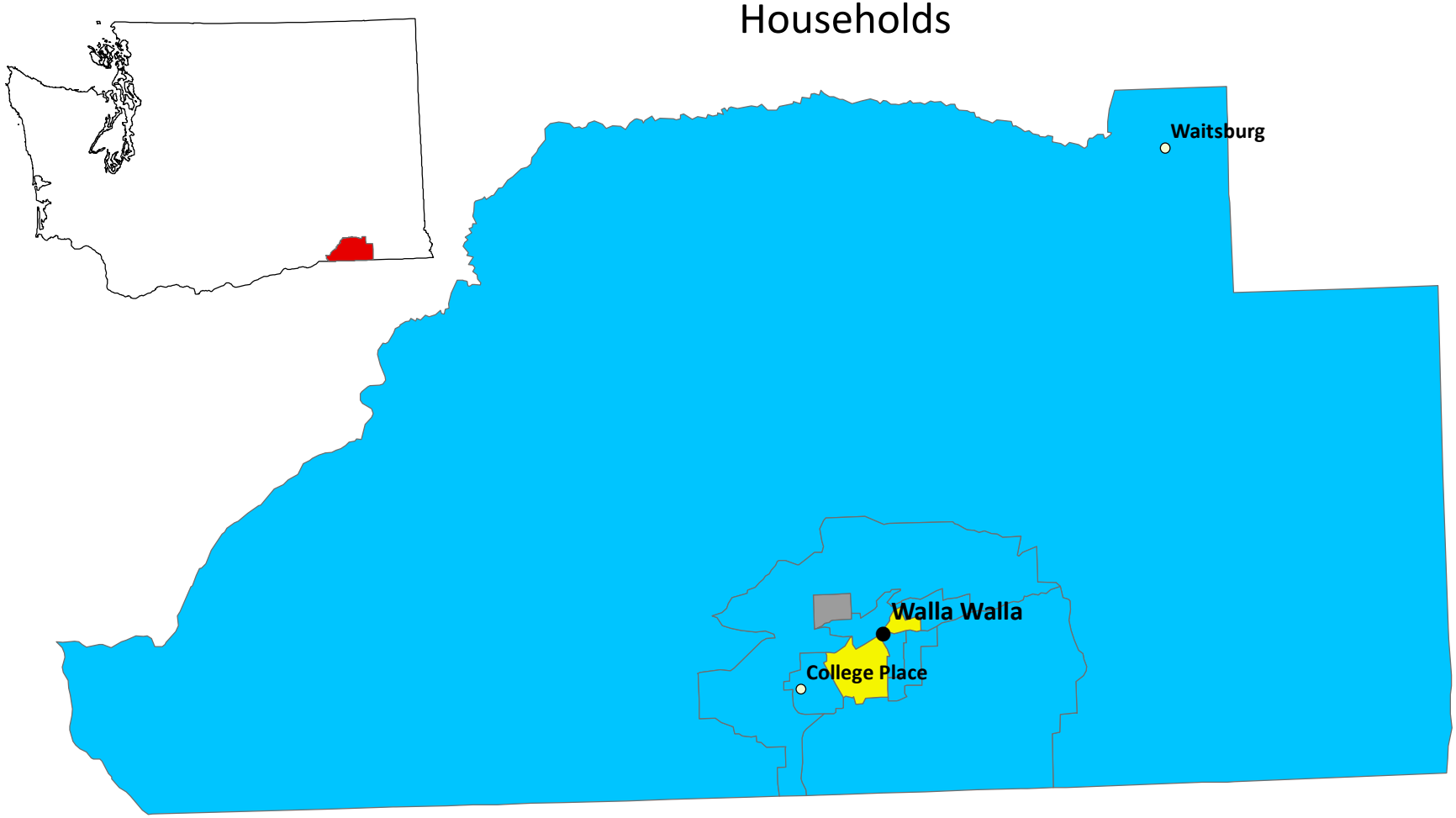


150% Penetration Ratio

- N/A
- 1% - 5%
- 6% - 10%
- 11% - 15%
- 16% - 20%
- 21% - 25%
- 26% +

Source: U.S. Census Bureau & WSDOT

Walla Walla District Average Heating Burden, Unsubsidized Households

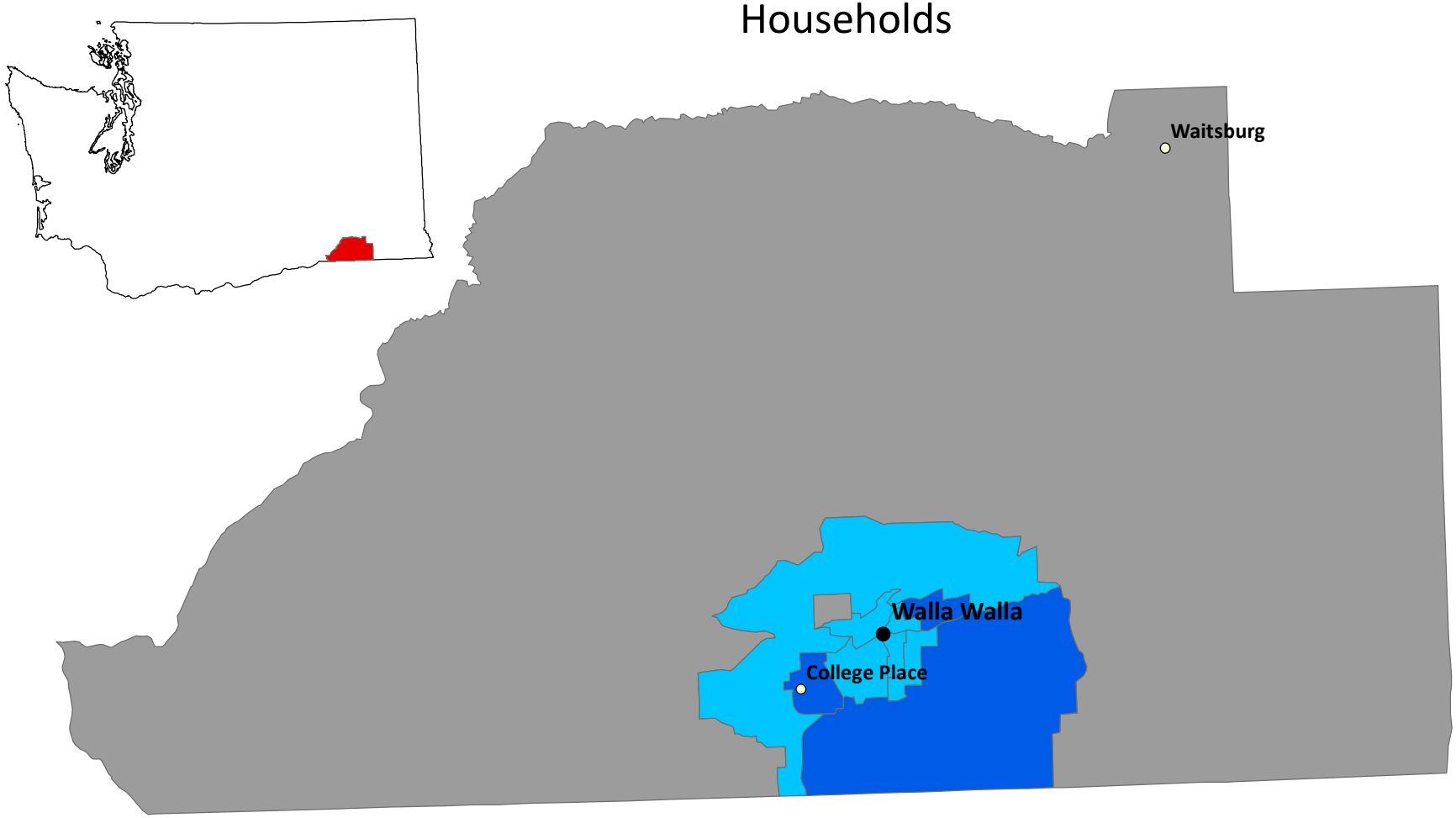


Average Heating Burden

- N/A
- 0.1% - 0.5%
- 0.6% - 1%
- 1.1% - 1.5%
- 1.6% - 2%
- 2.1% - 2.5%
- 2.6% +

Source: U.S. Census Bureau & WSDOT

Walla Walla District: Average Heating Burden, Subsidized Households

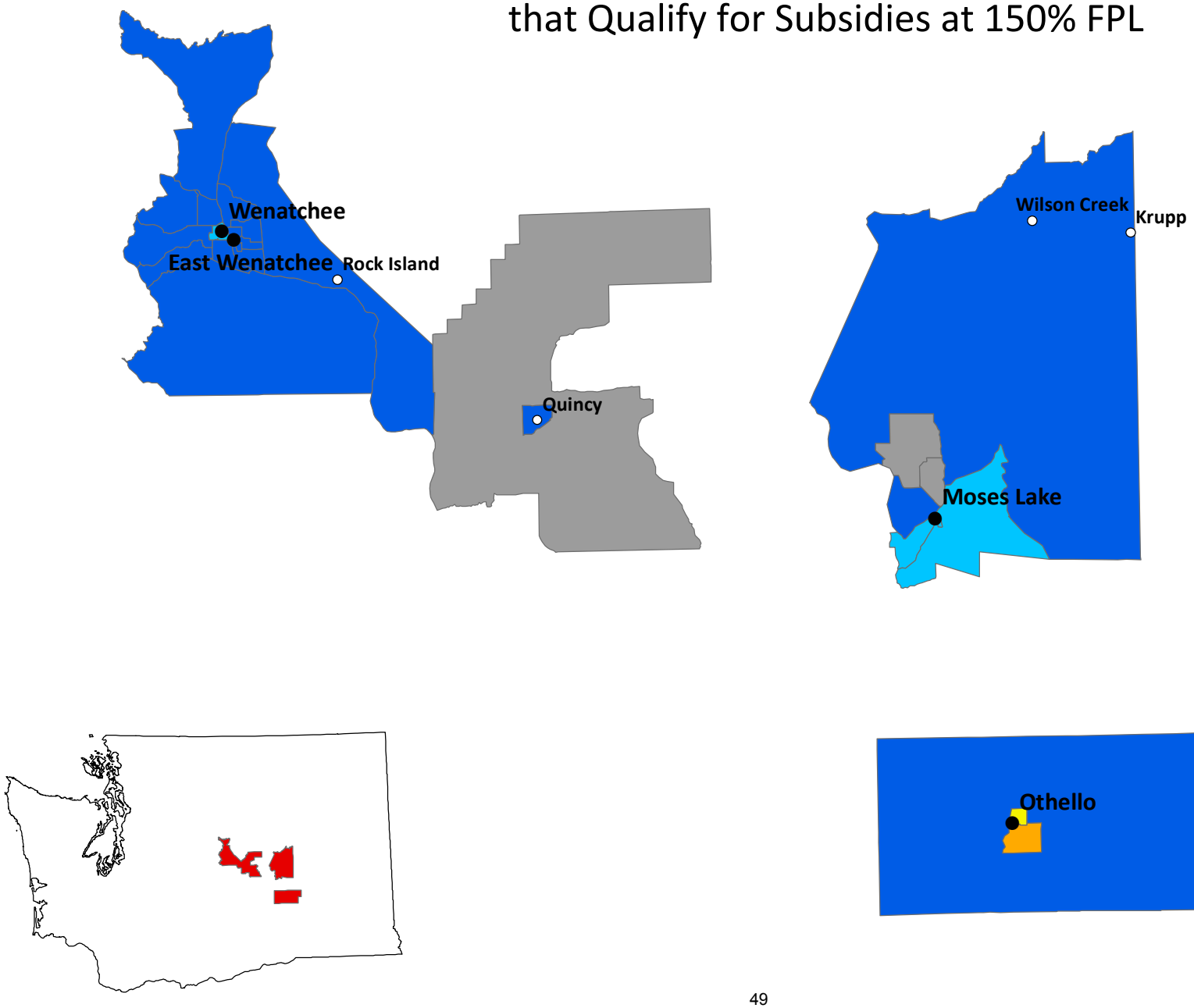


Average Heating Burden

- N/A
- 0.1% - 0.5%
- 0.6% - 1%
- 1.1% - 1.5%
- 1.6% - 2%
- 2.1% - 2.5%
- 2.6% +

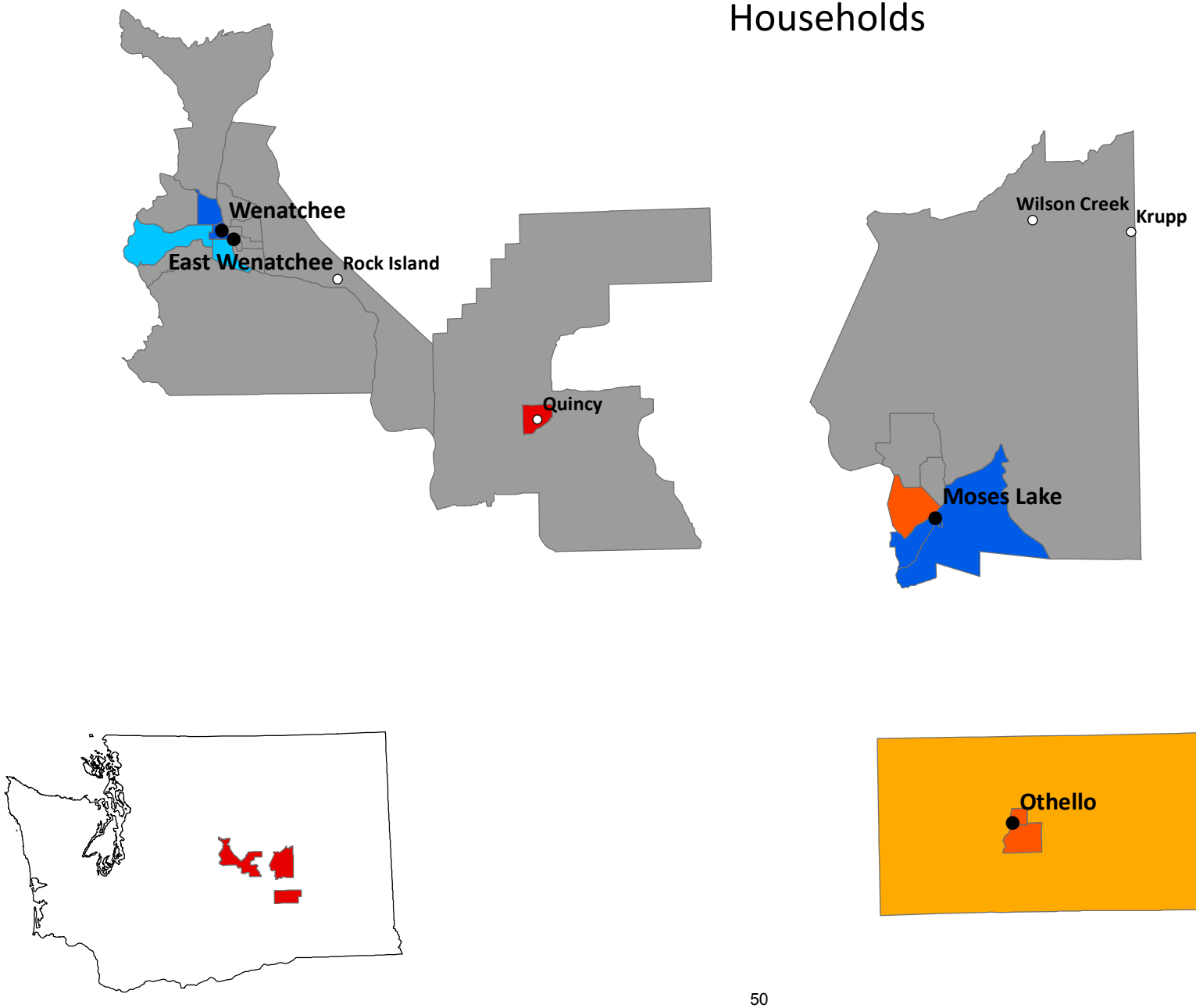
Source: U.S. Census Bureau & WSDOT

Wenatchee District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



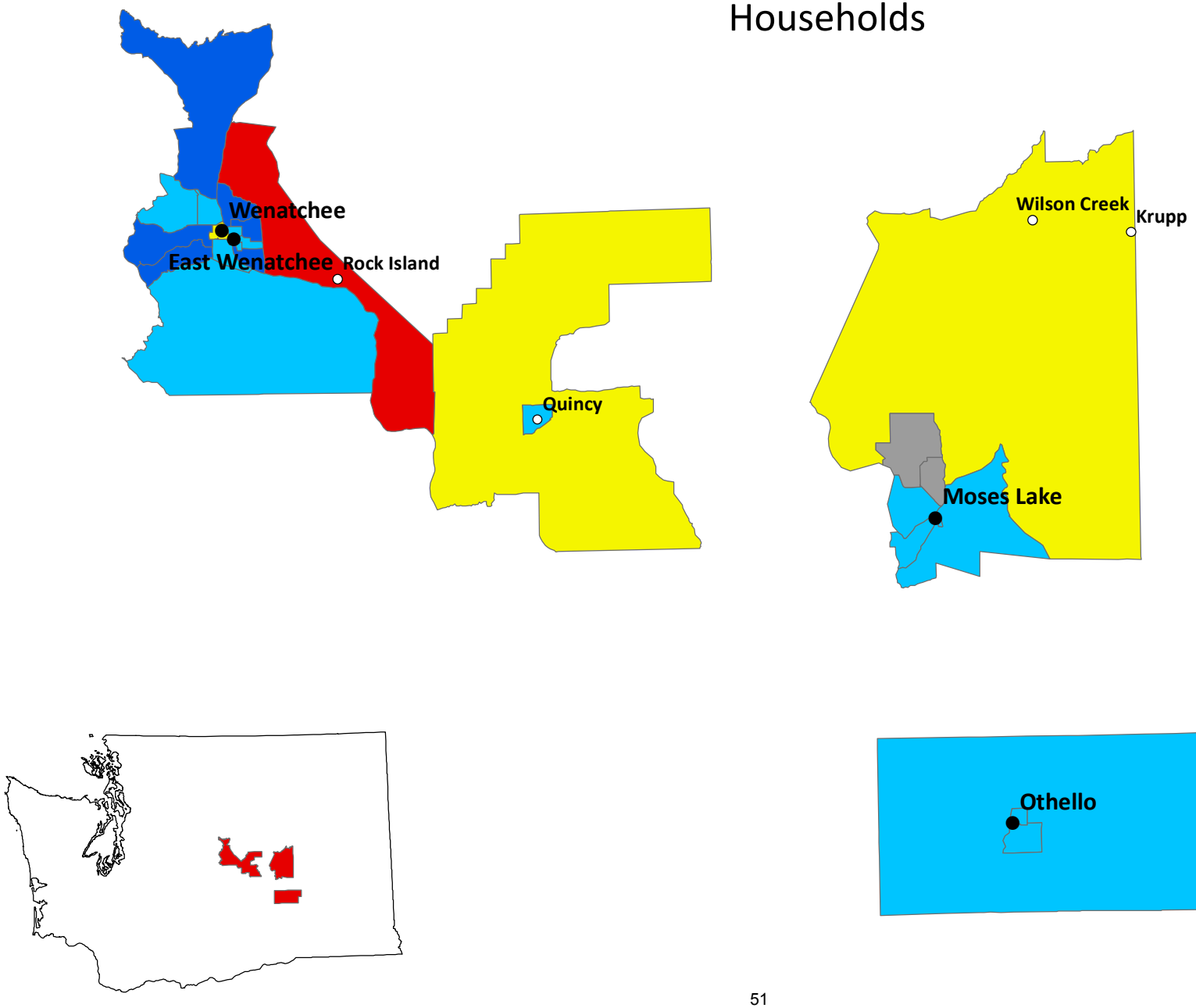
Source: U.S. Census Bureau & WSDOT

Wenatchee District: The 150% Penetration Ratio of Natural Gas Households



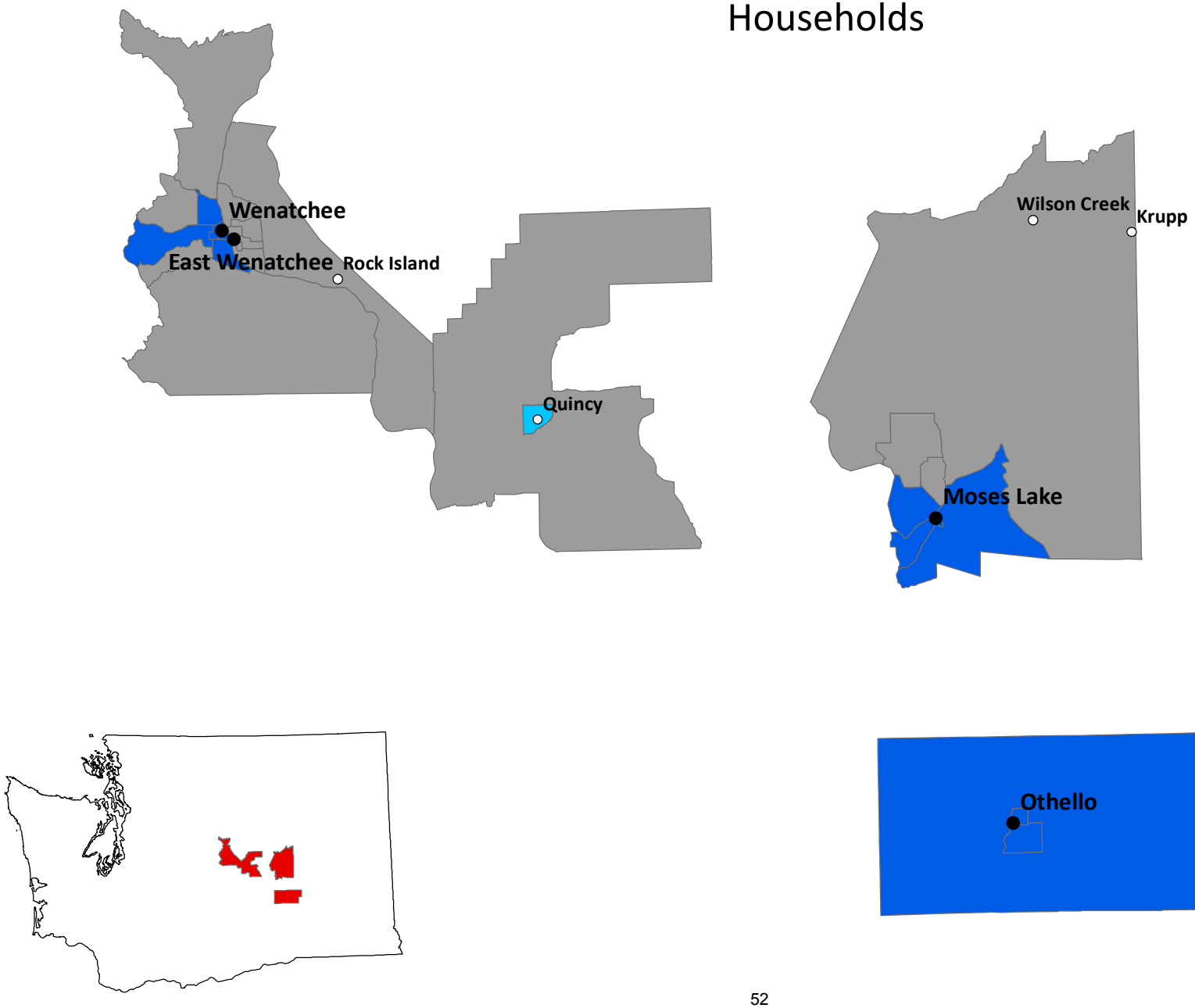
Source: U.S. Census Bureau & WSDOT

Wenatchee District Average Heating Burden, Unsubsidized Households



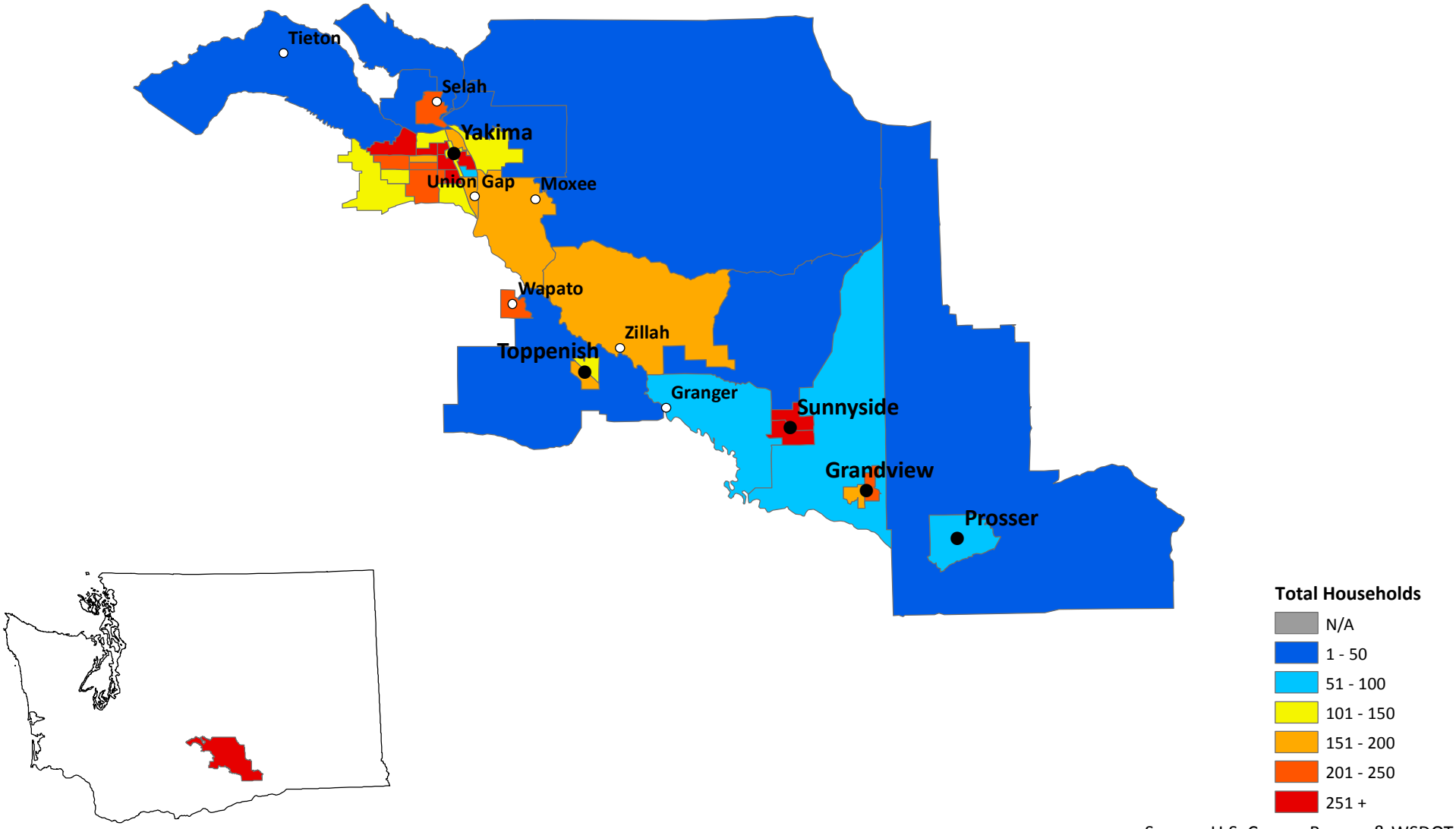
Source: U.S. Census Bureau & WSDOT

Wenatchee District: Average Heating Burden, Subsidized Households



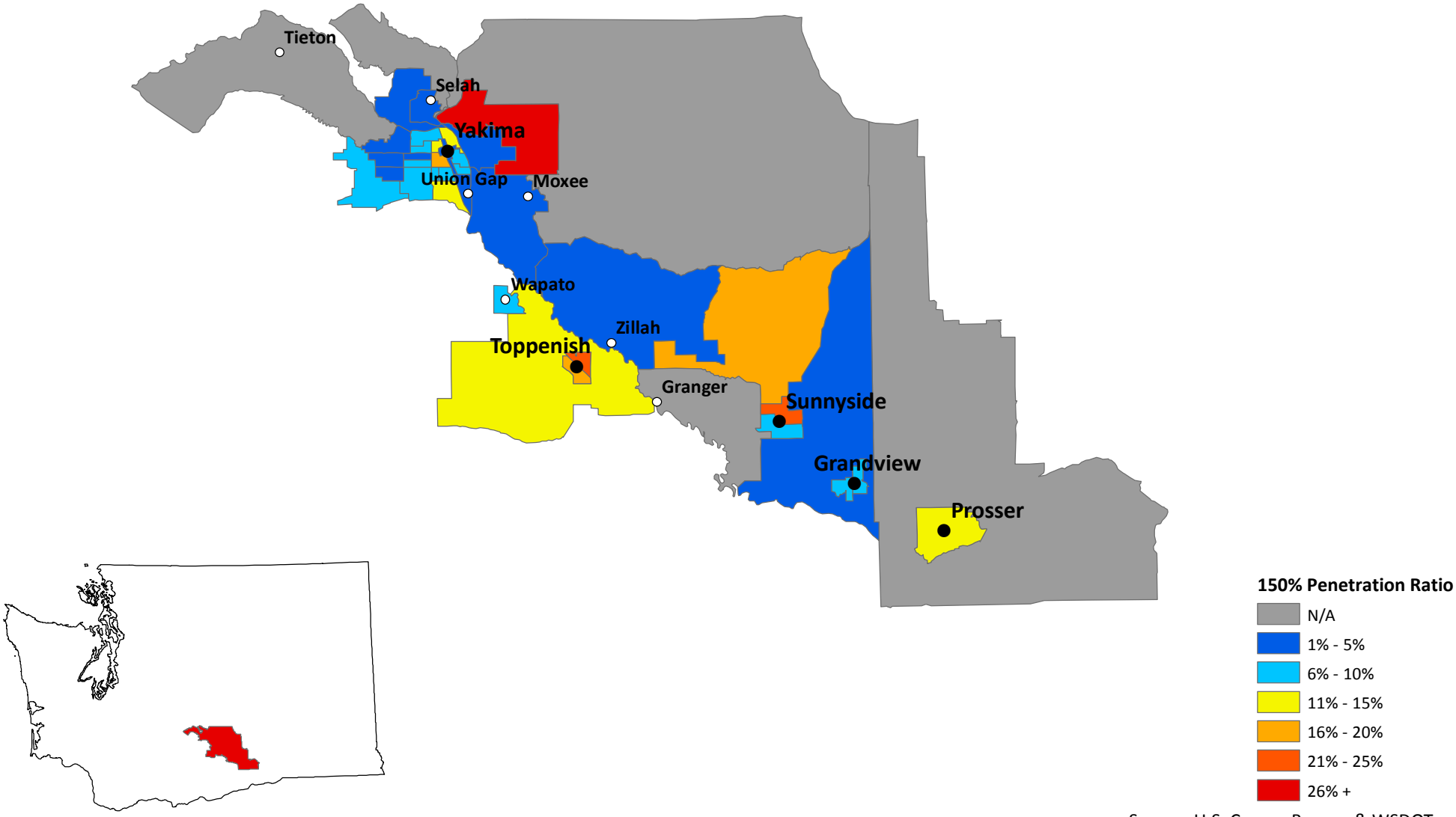
Source: U.S. Census Bureau & WSDOT

Yakima District: Number of Households Using Natural Gas that Qualify for Subsidies at 150% FPL



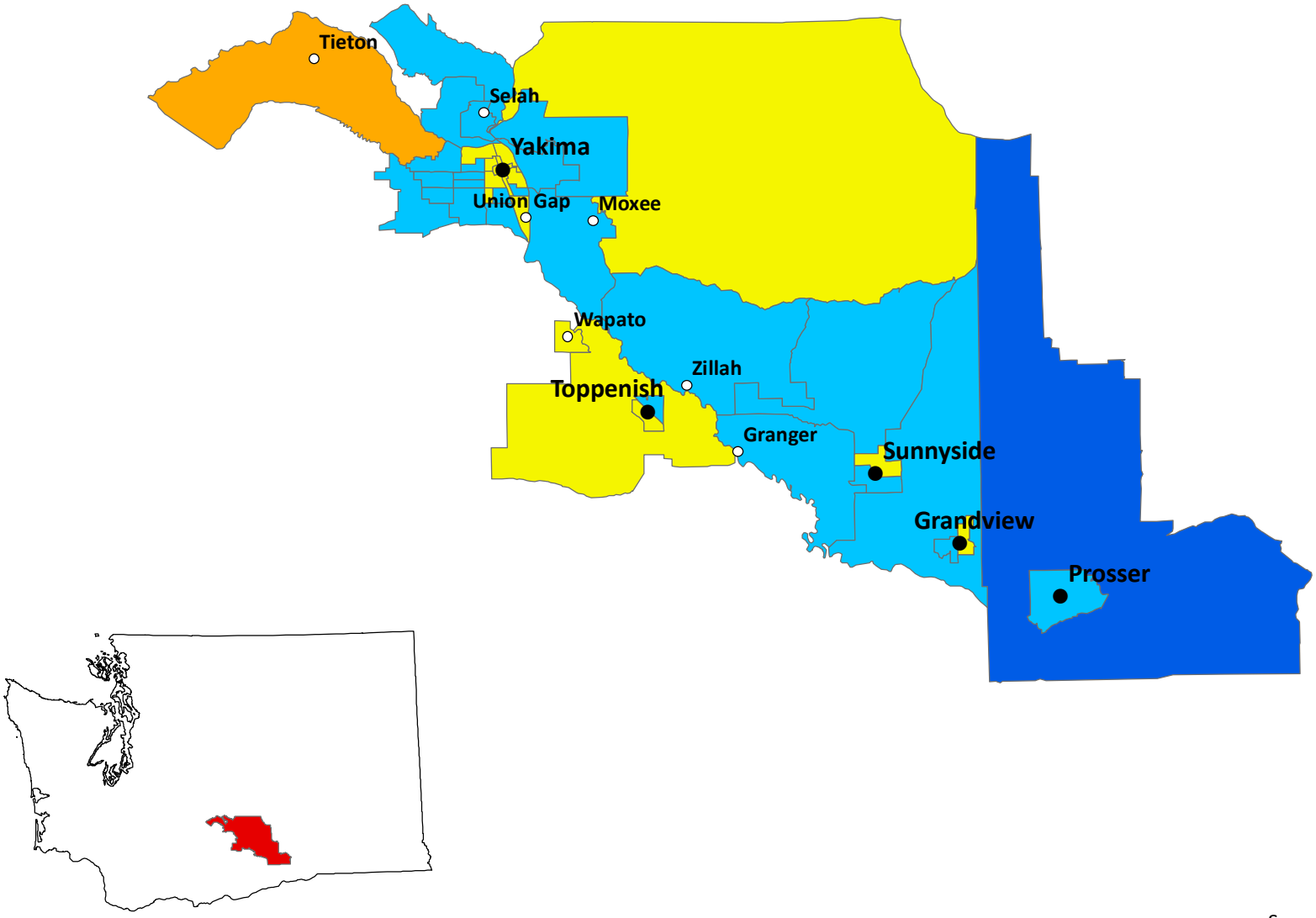
Source: U.S. Census Bureau & WSDOT

Yakima District: The 150% Penetration Ratio of Natural Gas Households



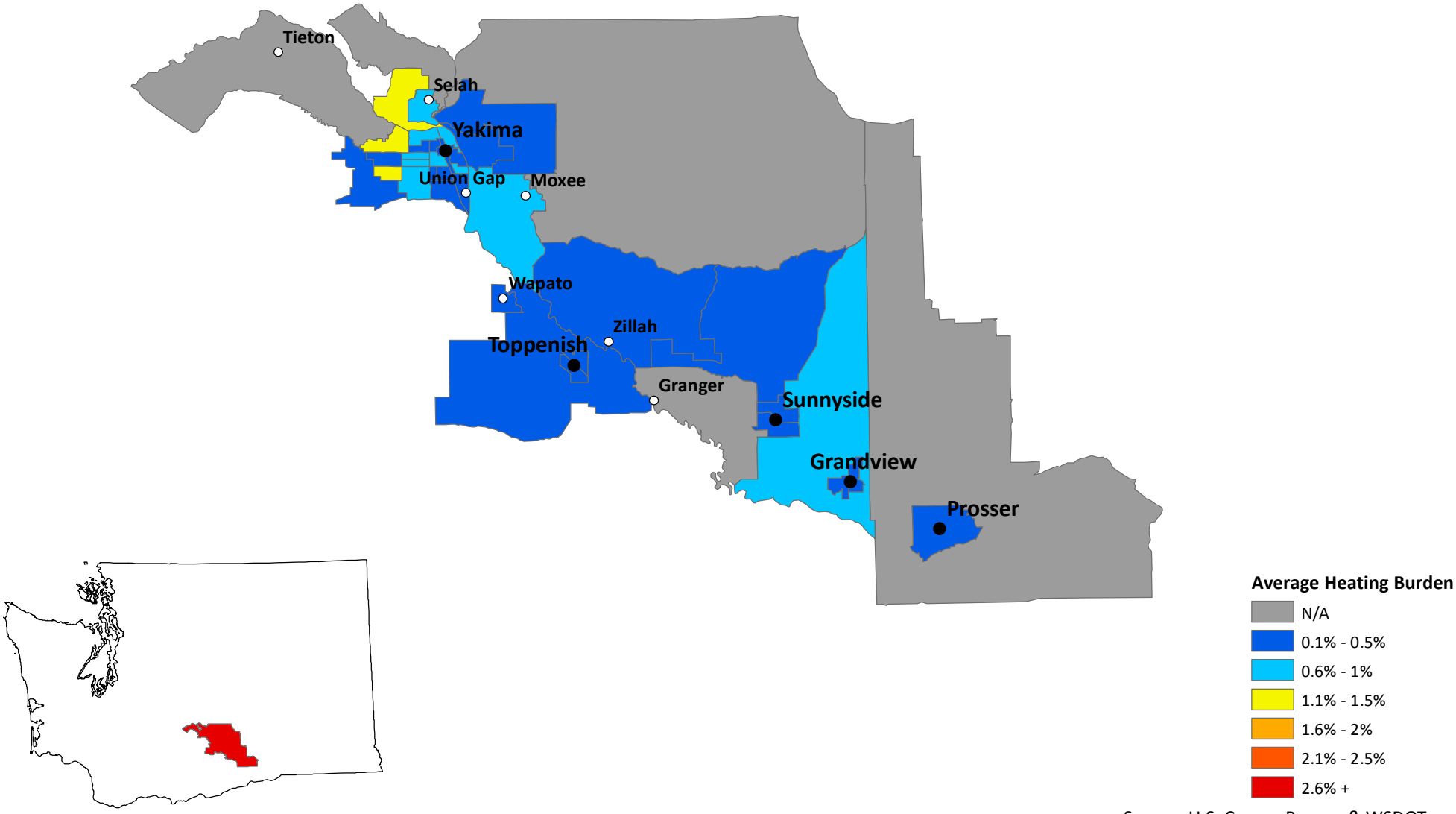
Source: U.S. Census Bureau & WSDOT

Yakima District Average Heating Burden, Unsubsidized Households



Source: U.S. Census Bureau & WSDOT

Yakima District: Average Heating Burden, Subsidized Households



Source: U.S. Census Bureau & WSDOT

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