

# WAP Warm Climate Weatherization: *Energy Savings Opportunities*

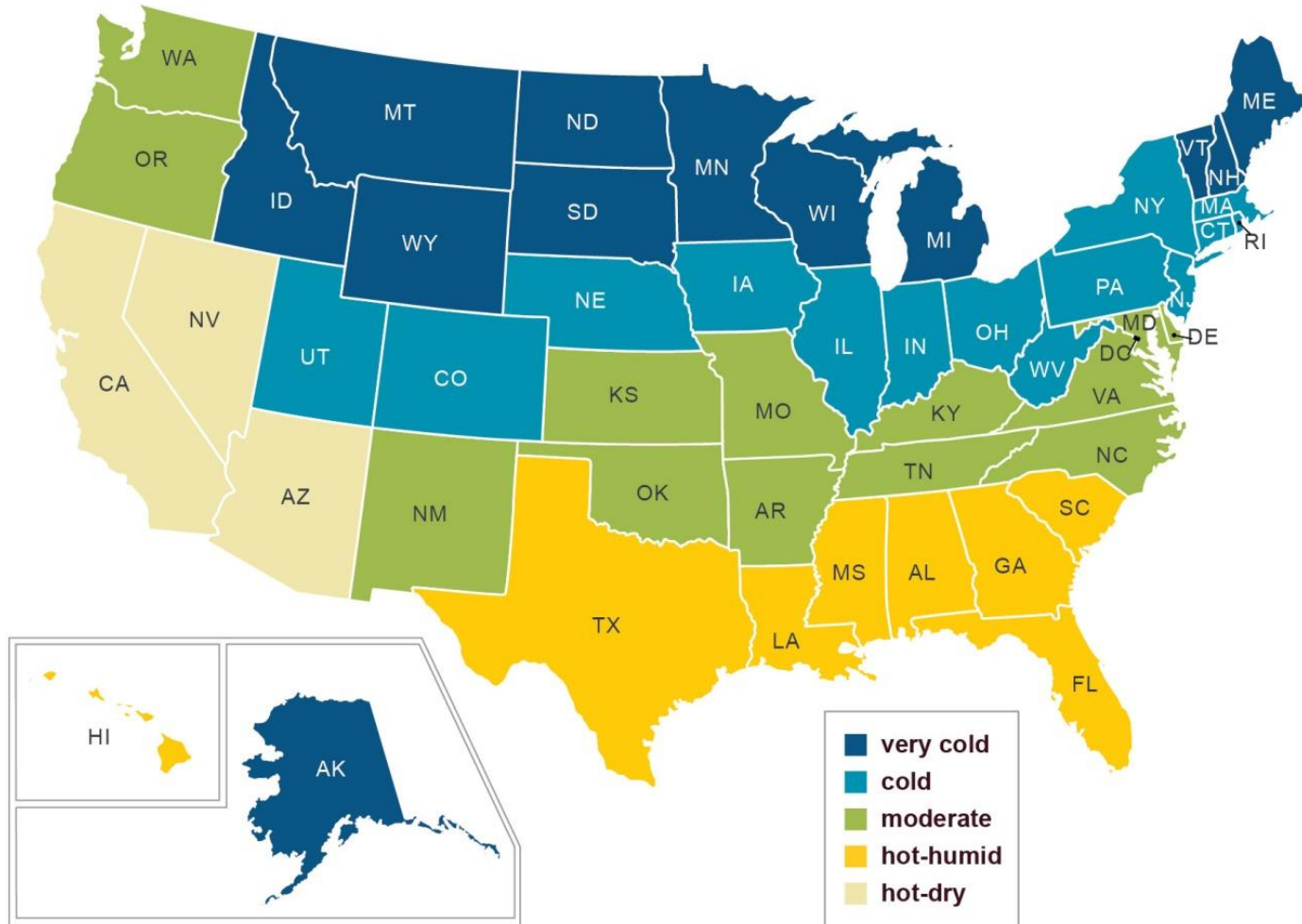
Kevin McGrath and Dan Bausch  
NASCSPP Winter Training Conference  
March 1, 2018

# Outline

- I. Needs Assessment** – What is the level of need for low-income weatherization in warm climates?
- II. WAP Performance in Warm Climates** – What can results from the National ARRA-period Evaluation tell us about WAP success in warm climates?
- III. New LIHEAP Performance Measures** – What can the new data that states are collecting for LIHEAP reporting tell us about opportunities in warm states?

# Needs Assessment for Low-Income Weatherization in Warm Climates

# Climate Zones



# WAP Eligible Population

Zone	Total Households	WAP Eligible Households	% Eligible for WAP
Very Cold	11,815,195	3,496,585	29.6%
Cold	37,436,040	11,089,262	29.6%
Moderate	25,296,900	8,068,110	31.9%
Hot-Humid	27,793,529	9,753,464	35.1%
Hot-Dry	16,518,389	5,224,098	31.6%
United States	118,860,053	37,631,519	31.7%

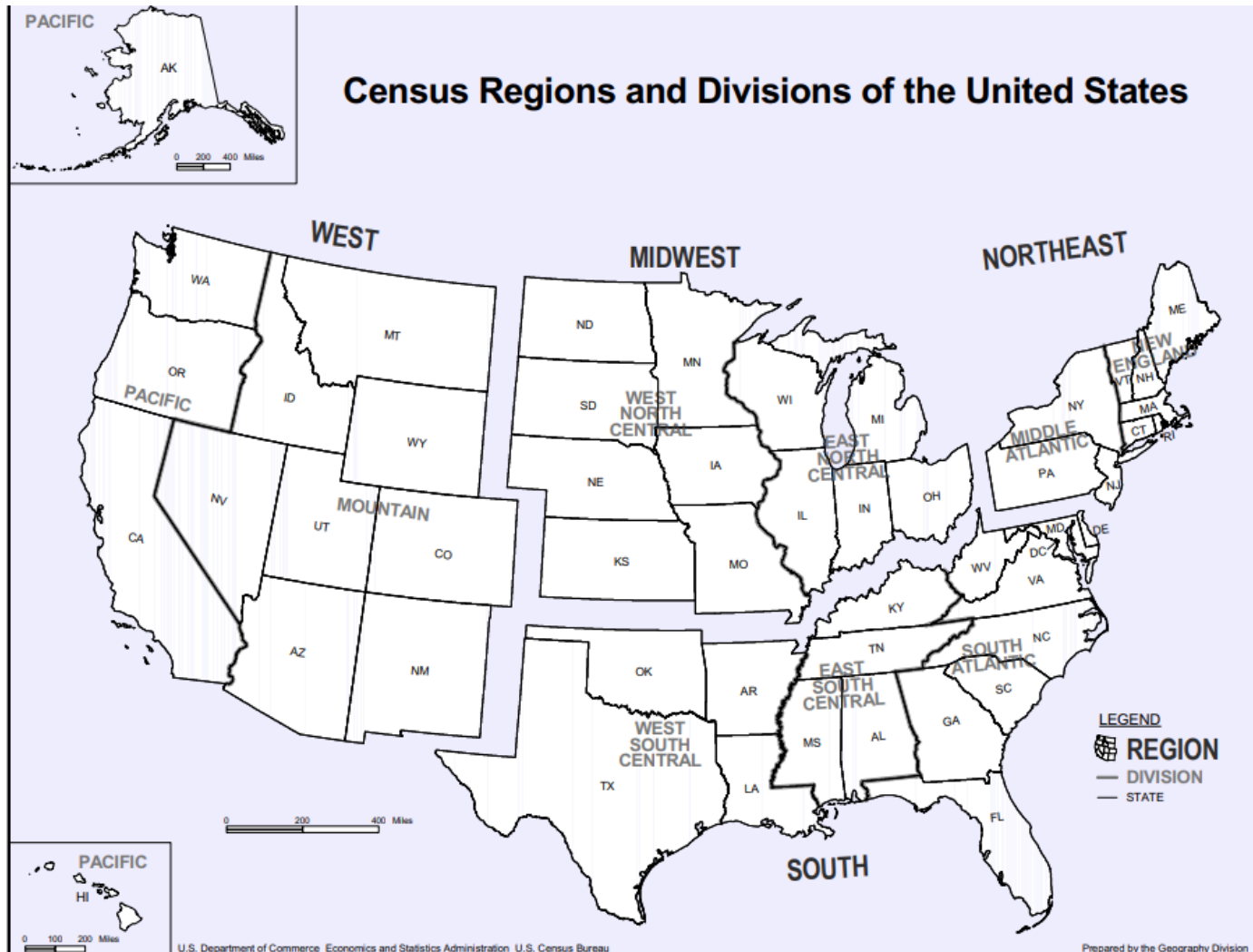
Source: 2016 American Community Survey (ACS)

# WAP Population Served

Zone	WAP Eligible Households	Total Funding Last 10 Years (Billions)	Total Units Served Last 10 Years	% Served Last 10 Years
Very Cold	3,496,585	\$2.420	261,995	7.5%
Cold	11,089,262	\$3.898	732,939	6.6%
Moderate	8,068,110	\$1.587	256,488	3.2%
Hot-Humid	9,753,464	\$0.787	102,019	1.0%
Hot-Dry	5,224,098	\$1.026	197,038	3.8%
United States	37,631,519	\$9.719	1,550,479	4.1%

Source: 2016 ACS, WAPTAC Funding Survey (PY2006-PY2015)

# Census Regions



# Average Annual Consumption (MMBtus) Low-Income Households

Census Region	Total Residential Energy	Home Heating	Home Cooling
Northeast	99.0	58.3	1.7
Midwest	107.7	59.3	2.3
South	66.0	19.7	7.3
West	60.3	18.7	3.3
United States	80.7	35.9	4.4

Source: FY 2014 LIHEAP Home Energy Notebook Estimates

Low-income = households income-eligible for LIHEAP under federal guidelines



# Source Energy

EPA recommends using source energy when comparing across different fuel mixes.

*“EPA has determined that source energy is the most equitable unit of evaluation. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses. By taking all energy use into account, the score provides a complete assessment of energy efficiency in a building.”*

Source:

<https://portfoliomanager.energystar.gov/pdf/reference/Source%20Energy.pdf>

# Average Annual Consumption (MMBtus) Low-Income Households – Source Energy

Census Region	Total Residential Energy	Home Heating	Home Cooling
Northeast	150.2	64.4	5.2
Midwest	180.8	69.9	7.1
South	160.3	32.9	23.0
West	121.9	26.7	10.4
United States	155.2	46.1	13.9

Source: FY 2014 LIHEAP Home Energy Notebook Estimates Converted to Source Energy  
Low-income = households income-eligible for LIHEAP under federal guidelines

# Average Annual Expenditures Low-Income Households

Census Region	Home Heating	Home Cooling	Total Residential Energy
Northeast	\$1,130	\$85	\$2,520
Midwest	\$759	\$75	\$1,935
South	\$415	\$266	\$1,859
West	\$279	\$128	\$1,342
United States	\$601	\$164	\$1,894

Source: FY 2014 LIHEAP Home Energy Notebook

Low-income = households income-eligible for LIHEAP under federal guidelines

# Average Annual Energy Burden Low-Income Households

Census Region	Home Heating		Home Cooling		Total Residential Energy	
	Mean	Median	Mean	Median	Mean	Median
<b>Northeast</b>	11.6%	4.6%	0.9%	0.3%	20.8%	11.1%
<b>Midwest</b>	9.6%	3.4%	0.9%	0.3%	18.9%	9.2%
<b>South</b>	5.9%	2.1%	3.7%	1.2%	20.5%	9.9%
<b>West</b>	3.3%	0.9%	1.2%	0.3%	11.8%	5.5%
<b>United States</b>	7.3%	2.4%	1.3%	0.5%	18.4%	9.5%

Source: FY 2014 LIHEAP Home Energy Notebook

Low-income = households income-eligible for LIHEAP under federal guidelines

# WAP Eligible Population: Main Heating Fuel

Zone	EL	NG	FO/KER	LPG	Other
Very Cold	22%	56%	7%	9%	6%
Cold	24%	59%	9%	4%	4%
Moderate	56%	31%	3%	5%	5%
Hot-Humid	73%	21%	0%	3%	3%
Hot-Dry	38%	52%	0%	3%	7%
United States	45%	42%	4%	4%	4%

Source: 2016 ACS

# WAP Eligible Population: Owner/Renter Status

Zone	Own	Rent	Other
Very Cold	49%	48%	3%
Cold	42%	56%	3%
Moderate	46%	50%	4%
Hot-Humid	48%	48%	4%
Hot-Dry	37%	60%	3%
United States	44%	52%	3%

# WAP Eligible Population: Housing Unit Type

Zone	Single Family	Small Multifamily (2-4 units)	Large Multifamily (5+ units)	Mobile Homes
Very Cold	58%	11%	24%	8%
Cold	50%	16%	29%	5%
Moderate	57%	9%	21%	13%
Hot-Humid	56%	9%	22%	13%
Hot-Dry	52%	10%	30%	7%
United States	54%	12%	25%	9%

Source: 2016 ACS

# WAP Eligible Population: Housing Age

Zone	Before 1980	1980-1999	2000-Present
Very Cold	65%	23%	12%
Cold	73%	18%	9%
Moderate	55%	29%	15%
Hot-Humid	48%	33%	19%
Hot-Dry	59%	28%	14%
United States	60%	26%	14%

Source: 2016 ACS



# WAP Eligible Population in Hot-Humid Zone: Deeper Look

- What are some of the household and housing unit characteristics that are important when considering how to target the population?
  - Owner/renter status
  - Housing unit type
  - Main heating fuel
  - Age of housing stock

# WAP Eligible Population: Owner/Renter by Housing Unit Type for Hot-Humid Zone

Owner/Renter Status	Single Family	Small Multifamily (2-4 units)	Large Multifamily (5+ units)	Mobile Homes
Own	77%	1%	4%	18%
Rent	34%	17%	41%	9%
Other	65%	5%	9%	20%
Total	56%	9%	22%	13%

# WAP Eligible Population: Housing Unit Type by Heating Fuel for Hot-Humid Zone

Housing Unit Type	EL	NG	FO/KER	LPG	Other
SFA/SFD	63%	30%	0%	4%	3%
SMF (2-4 units)	80%	17%	0%	1%	2%
LMF (5+ units)	88%	9%	0%	0%	3%
MH	83%	6%	1%	8%	2%
<b>Total</b>	<b>73%</b>	<b>21%</b>	<b>0%</b>	<b>3%</b>	<b>3%</b>

# WAP Eligible Population: Housing Unit Type by Housing Age for Hot Humid Zone

Housing Unit Type	Before 1980	1980-1999	2000-Present
<b>SFA/SFD</b>	57%	26%	17%
<b>SMF (2-4 units)</b>	50%	35%	16%
<b>LMF (5+ units)</b>	42%	37%	21%
<b>MH</b>	24%	55%	21%
<b>Total</b>	48%	33%	19%

Source: 2016 ACS

# Targeting WAP Eligible Population in Hot-Humid Zone

- Mainly electric heat, equal proportions owner/renter, mainly SF homes but greater proportion of MH than other zones
  - If targeting owners, looking at SFA/SFD with some more gas opportunities and older buildings
  - If able to reach renters, looking at SMF/LMF with mostly electric opportunities in slightly newer buildings

# Other Demographic and Regional Changes

- Dramatic population increase
- Increase in Air Conditioning
  - Since 1993, electricity consumed for air conditioning in the South has increased 43% (EIA, 2009 RECS).
- Increase in the number of hot days above 95 degrees in the Southeast since 1970 and expected to increase in the coming decades (National Climate Assessment).

WAP Performance in Warm Climates:  
*Findings from the National WAP  
ARRA Evaluation*

# National WAP Evaluation

Comprehensive, peer-reviewed evaluation efforts examining WAP during two distinct periods to produce national and regional climate zone results.

- *PY 2010 ARRA Evaluation*
  - Assess program during ARRA period
  - Client data collected for ~35,000 WAP households
  - Energy usage data collected from ~400 utilities



# WAP During ARRA

<i>National WAP Statistics</i>	<b>PY 2010 (ARRA)</b>
<b>Total DOE Funds</b>	\$2 billion
<b>Total Leveraged Funds</b>	\$317 million
<b>Total Housing Units Served</b>	340,158
<b>Average Cost per Housing Unit</b>	\$6,812
<b>Income Limit</b>	200% of Poverty
<b># of State Sub-grantees</b>	928



# WAP Single Family Homes By Climate, PY 2010

Zone	PY10 Units	Percent
Very Cold	40,870	19%
Cold	78,381	36%
Moderate	40,459	19%
Hot-Humid	36,047	17%
Hot-Dry	19,688	9%

# Home Characteristics

Zone	Central AC	Electric Suppl. Heat	Mean CFM50
Very Cold	15%	10%	2,789
Cold	30%	12%	3,227
Moderate	59%	20%	3,489
Hot-Humid	62%	21%	3,429
Hot-Dry	52%	12%	1,948

# Home Characteristics in Warm Climates

- Central AC used by 60% of WAP households in warm zones compared to 30% in the cold zone and 15% in the very cold zone
- Electric supplemental heat use is 2 times as much as in colder climates
- Air leakage rates highest at more than 3,400 CFM50.

# Gas Savings by Climate, 2010

<b>Zone</b>	<b>Sample Size</b>	<b>Pre-WAP Therms</b>	<b>Net Savings Therms</b>	<b>Percent</b>
<b>Very Cold</b>	2,149	1,040	157 (+/-13)	15.1%
<b>Cold</b>	2,990	1,091	188 (+/-13)	17.2%
<b>Moderate</b>	792	828	125 (+/-24)	15.1%
<b>Hot-Humid</b>	368	558	81 (+/-23)	14.6%
<b>Hot-Dry</b>	293	545	12 (+/-17)	2.1%

# Electric Savings for Gas-Heated Homes by Climate, 2010

Zone	Sample Size	Pre-WAP kWh	Net Savings kWh	Percent
Very Cold	1,878	8,594	560 (+/-102)	6.5%
Cold	3,518	8,673	632 (+/-104)	7.3%
Moderate	943	11,315	937 (+/-270)	8.3%
Hot-Humid	526	11,537	1,302 (+/-270)	11.3%
Hot-Dry	406	8,440	686 (+/-217)	8.1%

# Gas + Electric MMBtus for Gas Heated Homes (Source Energy Comparison)

Zone	Sample Size	Pre-WAP Source MMBtus	Net Savings Source MMBtus	Percent
Very Cold	2,149	201.3	22.5	11.2%
Cold	2,990	207.5	26.5	12.8%
Moderate	792	208.2	23.2	11.1%
Hot-Humid	368	182.2	22.5	12.3%
Hot-Dry	293	147.7	8.6	5.8%



# Savings for Gas-Heated Homes

- Hot-Humid had lower gas savings amounts, but had comparable percentage savings to the Very Cold Region due to lower pre-WAP usage.
- Hot-Humid and Moderate had the highest electric baseload savings for gas-heated homes.
- When combining results and looking at source energy, Moderate does better in overall savings than Very Cold and Hot-Humid has approximately the same as Very Cold.

# What about Electric Main Heat Households?

Zone	Sample Size	Pre-WAP kWh	Net Savings kWh	Percent
Warm	689	18,577	1,837 (+/-375)	9.9%
Cold	603	21,410	2,021 (+/-392)	9.4%

Warm: <3,500 HDD65

Cold: =>3,500 HDD65

# Measures Installed

Zone	Any Air Sealing	Attic Insulation	Wall Insulation
Very Cold	76%	67%	32%
Cold	96%	64%	32%
Moderate	88%	62%	14%
Hot-Humid	97%	67%	17%
Hot-Dry	70%	19%	<1%

# Measures Installed (Cont.)

<b>Zone</b>	<b>Mechanical Ventilation</b>	<b>AC</b>	<b>Refrigerator</b>
<b>Very Cold</b>	19%	1%	27%
<b>Cold</b>	16%	1%	18%
<b>Moderate</b>	17%	13%	16%
<b>Hot-Humid</b>	32%	23%	24%
<b>Hot-Dry</b>	5%	9%	14%

# Job Costs

<b>Zone</b>	<b>Mean Cost</b>	<b>Mean ECM Costs</b>	<b>Mean # of Major Measures</b>
<b>Very Cold</b>	\$5,543	\$4,790	1.6
<b>Cold</b>	\$4,242	\$3,582	1.6
<b>Moderate</b>	\$4,308	\$3,677	1.4
<b>Hot-Humid</b>	\$5,421	\$4,696	1.5
<b>Hot-Dry</b>	\$2,482	\$2,052	0.5

# Summary of Findings

- WAP can produce strong savings in warm climates, as shown in the ARRA period
  - Savings for gas-heated home in Hot-Humid and Moderate climate zones comparable to Very Cold.
  - Savings for electric-heated homes in warm climates comparable to cold climates.
- Measure installation rates show room for improvement
- Analysis across climate zones points to the need to prioritize high usage and major measures

# New LIHEAP Performance Measures Data

# LIHEAP Performance Measures

- Beginning with FY 2016, HHS required all states to submit data for four new LIHEAP Performance Measures
  1. The Benefit Targeting Index
  2. The Burden Reduction Targeting Index
  3. The Restoration of Home Energy Service
  4. The Prevention of Loss of Home Energy Service



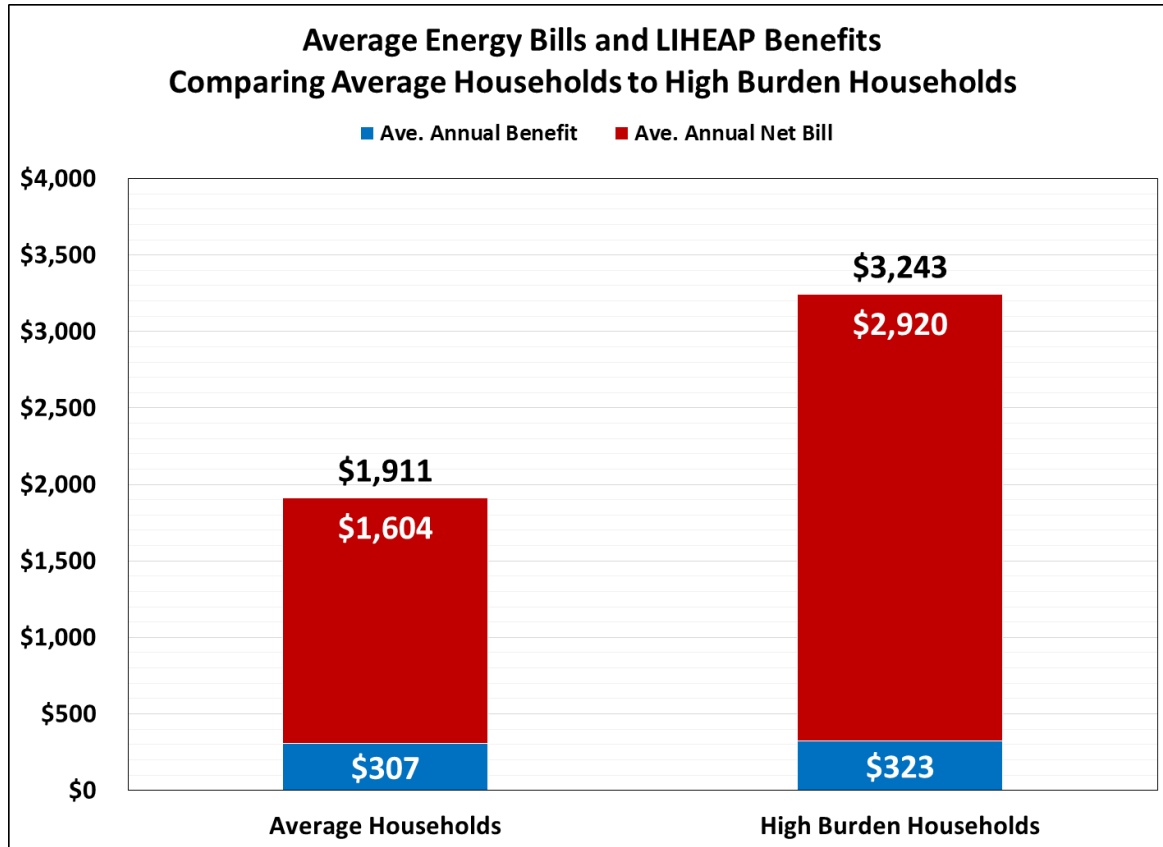
# Data Collected

- States are collecting valuable information about the low-income households from utilities and energy vendors in support of this reporting requirement
  - Annual Main Heat Expenditures
  - Annual Electricity Expenditures
  - Annual Main Heat Usage [Optional]
  - Annual Electricity Usage [Optional]
  - Use of Supplemental Heat (electric, wood, other) [Optional]
  - Use of Air Conditioning (central AC, wall/room) [Optional]

# Valuable Results

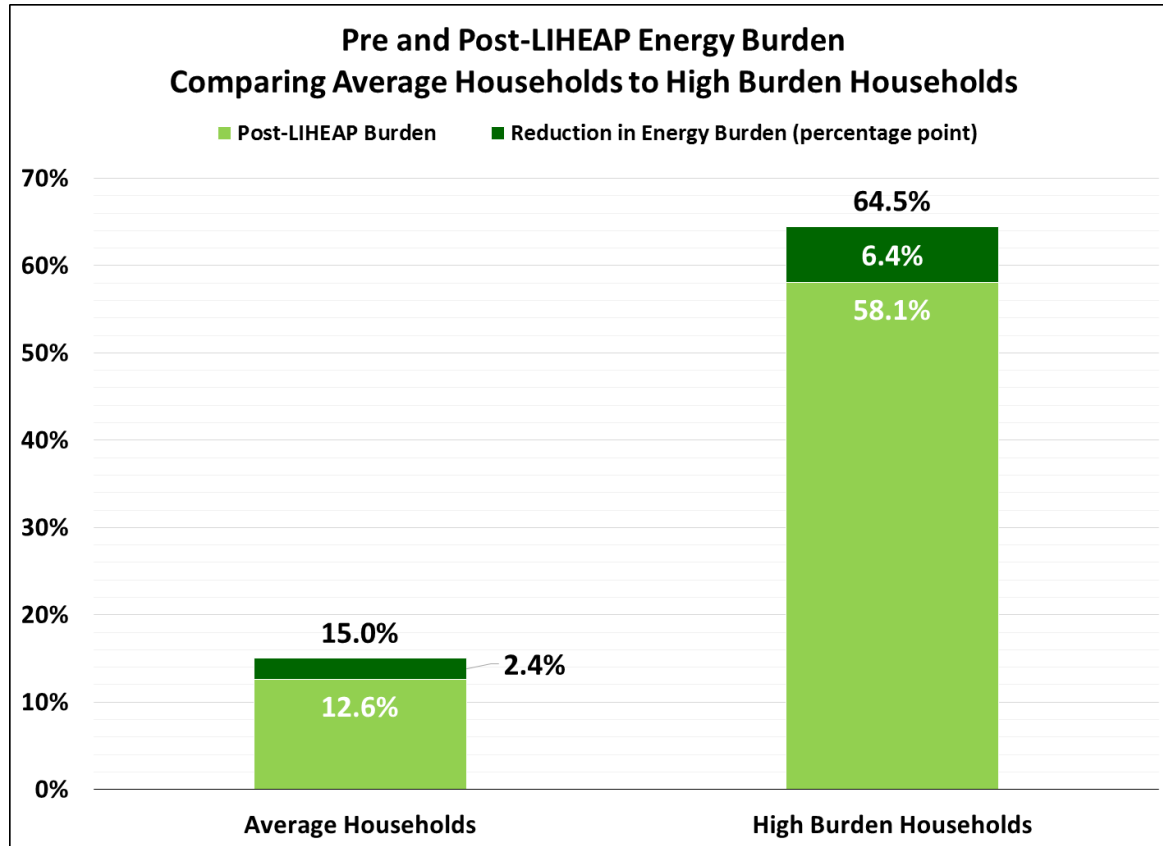
- Average annual energy expenses by fuel type
- Average energy burden by fuel type
- Statistics for all LIHEAP households versus top 25% based on energy burden

# Example #1 – Expenditures



The data show that some recipients have very high energy bills – average for high burden recipients is >\$3,000

# Example #2 – Energy Burden



The data show that some recipients have very high energy burden – average for high burden recipients is 4x greater than all recipients

## Example #3 – Equipment Use

- Supplemental Heating Use – 4% of all LIHEAP recipients in state
  - 16% of LIHEAP recipients using natural gas main heat use a supplemental heating source
  - 10% of LIHEAP recipients using fuel oil main heat use a supplemental heating source
- Window/Wall AC Use – 18% of all LIHEAP recipients in state

# How can the data help warm weather states?

- The Performance Measures provide actual energy expenditure data documenting the need for additional ratepayer-funded energy efficiency programs
- The data can help to identify subgroups with greater needs
- Opportunity for referrals from LIHEAP to WAP for those with the highest usage

# Conclusions

# Conclusions

- Need for Low-Income Weatherization in the Warm Climate States
  - Low-income households in warm southern climates have energy expenses and energy burdens comparable to the Midwest
  - Less of the income-eligible population in the warmer climate zones served, but also less funding available
  - Comparatively few ratepayer programs targeted at low-income households in the South



# Conclusions

- WAP Performance in Warm Climates
  - Combined gas/electric savings for gas-heated homes in the Hot-Humid and Moderate zones was comparable to the Very Cold zone.
  - Electric main heat savings in warm regions similar to cold regions.
  - Measure installation rates show room for improvement.
  - Analysis across climate zones points to the need to prioritize high usage and major measures

# Conclusions

- New LIHEAP Performance Measures
  - The warm weather state LIHEAP offices are collecting energy expenditure data that can help to document the need for additional ratepayer funded energy efficiency programs in those states.
  - WAP offices can coordinate with LIHEAP to review the data and discuss ways to target high usage LIHEAP recipients.
    - Example = Minnesota

# Conclusions

- Continued opportunity for WAP to maximize energy savings in warm climates
  - Target high usage customers
  - Identify opportunities for major measure installations
  - Conduct performance management to assess work quality
  - Conduct evaluations to assess if goals are achieved

# Contact

Kevin McGrath, 609-252-2081  
[Kevin-McGrath@appriseinc.org](mailto:Kevin-McGrath@appriseinc.org)

Dan Bausch, 609-252-9050  
[Daniel-Bausch@appriseinc.org](mailto:Daniel-Bausch@appriseinc.org)

APPRISE  
32 Nassau Street, Suite 200  
Princeton, NJ 08540