Groundswell

The Poor Still Pay More

Solutions In Efficiency and Clean Energy for Energy Impoverishment and Energy Insecurity

Energy Futures 2021 Webinar

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Groundswell

Dr. Elvis Moleka
Director of Data Science Research and Analytics

Dr. Elvis Moleka is the Director of Data Science Research and Analytics at Groundswell. His passionate pursuit of data-based solutions to long-standing issues has uncovered previously unexplored research possibilities in the realm of energy forecasting. Dr. Moleka has more than 15 years of progressive experience in finance, risk management, data, and quantitative analytics, performing complex model validation analyses, and creating executive summaries of findings. As a Data Scientist, he leverages statistical analysis and econometrics knowledge to promote model development and data management solutions. He is a member of the New York Institute of Finance. He has worked with major Wall Street Banks and held many leadership positions such as Lead Quantitative Analyst at RiskSpan, Senior Economist at Fannie Mae, Lecturer in Statistics, and Head of Teaching Fellows at the University of Warwick, and Research Economist at the University of Bath.

Motivation

- Despite energy abundance in the US and the propagation of energy efficiency programs and weatherization policies, low-income households continue to pay high energy bills while their environmental, social, and economic conditions erode.
- Lack of energy equity
  - Not many low-income households benefit from energy-efficiency programs that are designed to reduce economic hardship and poverty
  - Clean energy equity and transparency
- Eligibility vs availability - there is far greater eligibility and need to participate in existing bill payment assistance and weatherization programs than there is availability.
- Lack of empirical research on LMI energy burdens.

Objectives

- Discuss how and why energy burdens are often heavier for households in certain states or with certain incomes.
- Assess opportunities that offer the greatest hope to reduce energy burdens in the US.
- Investigate the relationship between energy burden and energy prices, characterized by average monthly bill payment.

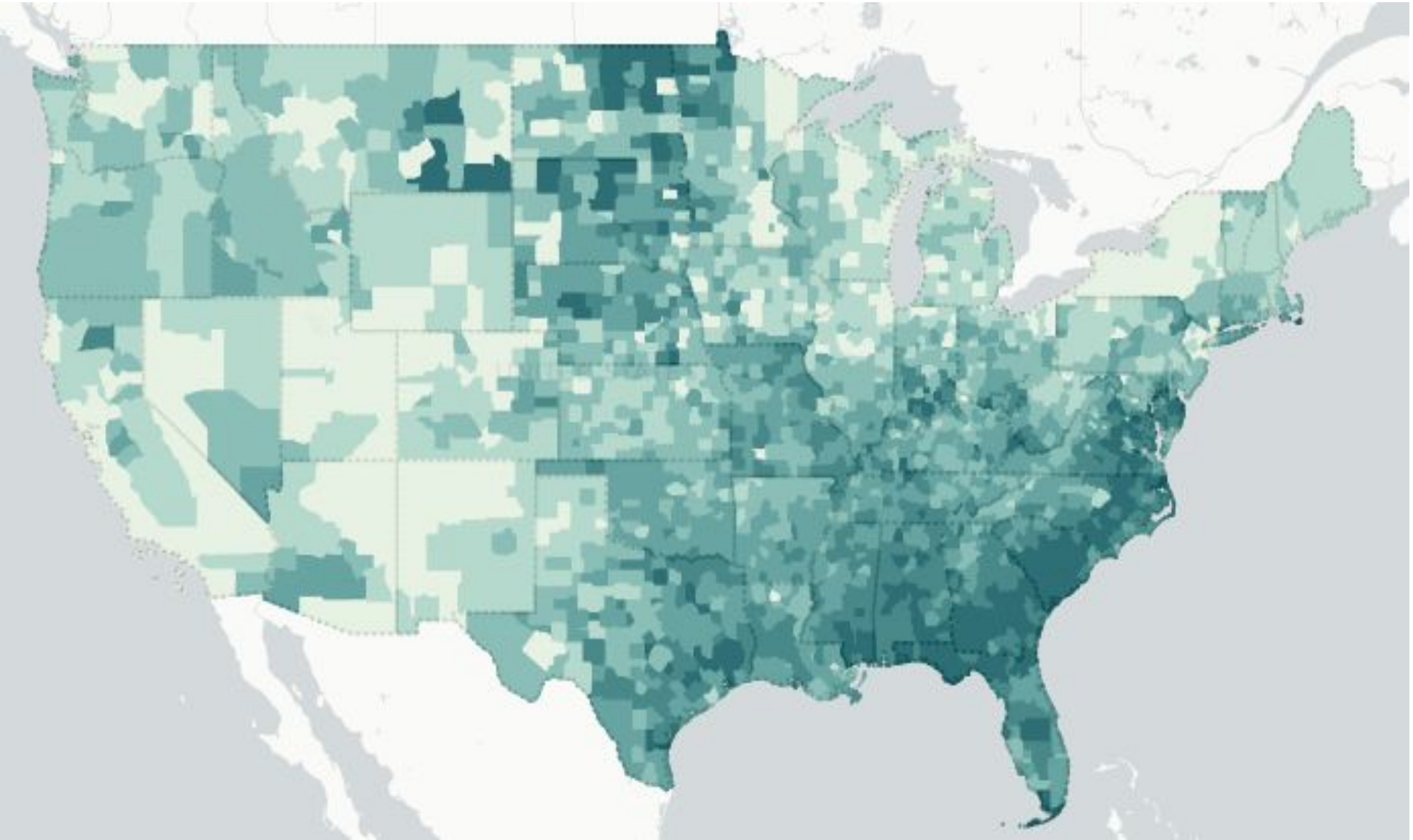
Key Takeaways

- Utility bills, housing stock and poverty rates present a threat to affordability of residential housing in the US.
- The result of this analysis shows regional imbalances in energy burdens, which are greatest in the Southeast and Northeast regions of the country.
- Most LMI households are energy impoverished, and more than two-thirds experience energy burdens that are above double digits.
- Utilities still charge the poor more – utility providers often charge different and higher upfront costs to low-income customers
- Efficiency is a winner - improving energy use especially for rural, older housing stock.

Brief Literature Review

- Rural energy burdens - McCormick (2015), Shoemaker et al. (2018)
- Demographic shift – Hernandez (2015), Wang et al. (2021)
- Implications on health – Wright (2004), Hernandez & Bird (2010), Liddell & Morris (2010), Dear & McMichael (2011), Li et al. (2014), & Reames et al. (2021).
- Energy burden as an economic problem – propagated by housing type: Drehobl & Ross (2016), Brown et al. (2020), Reina and Kontokosta (2017), Kontokosta et al. (2019), Cook and Shah (2018), Buylova (2020), Hernandez and Phillips (2015)
- Energy affordability – Heindl (2015), Li et al. (2014), Ray et al. (2019), Mohr (2018)
- Energy poverty – Hilbert and Werner (2016), Chai et al. (2021), Bohr and McCreery (2020)

LMI Household Electricity Expenditures (cost per month)

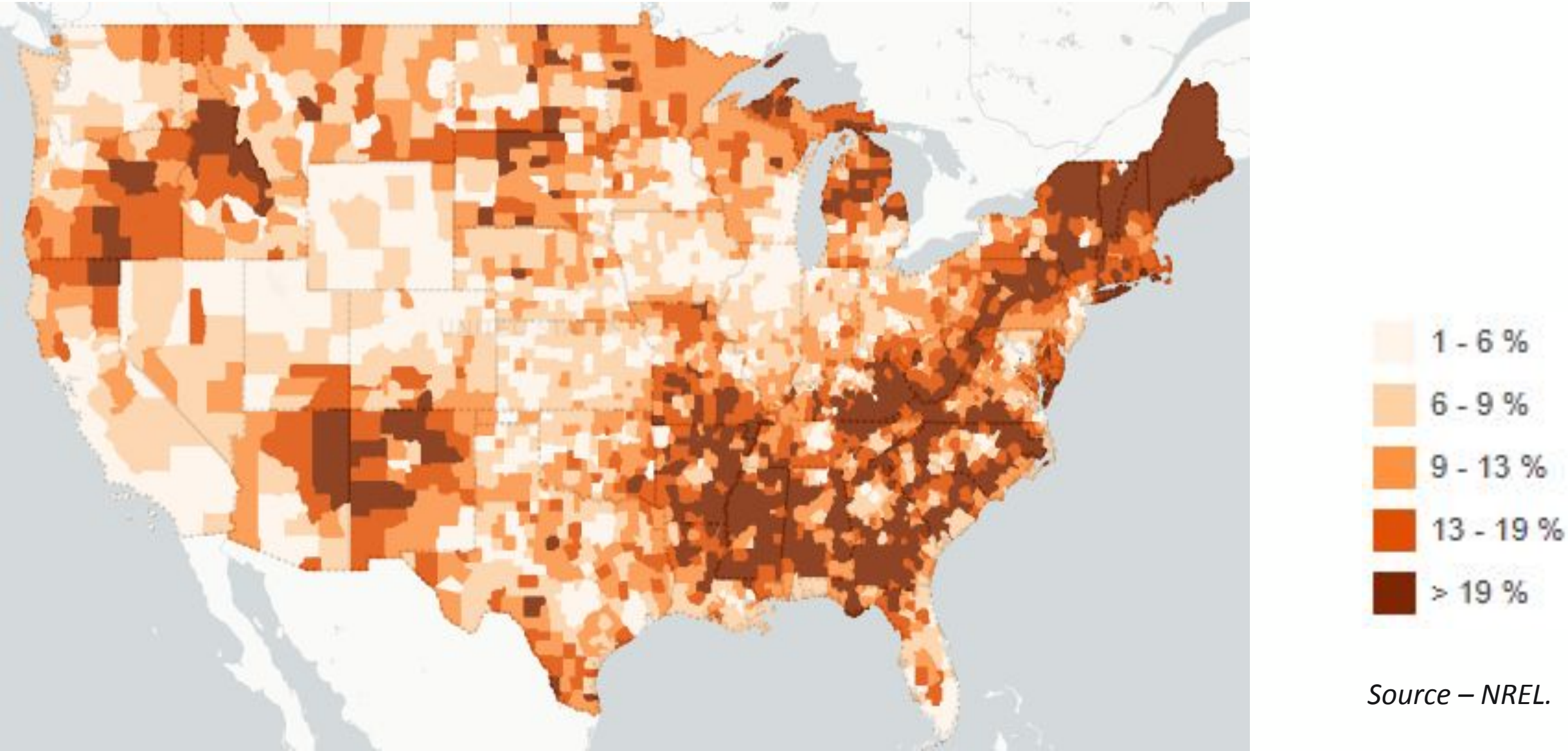


0 to 80
80 to 100
100 to 120
120 to 140
140 to 160
> 160

Source – NREL.

Energy Burden

(percent of income spent on household energy bills)



Source – NREL.

Energy Burdens are Much Worse in Certain States

Energy burdens have grown over the last decade due to **systemic inequities in housing stock, employment and energy rates**, in addition to dramatic energy burden increases during the COVID-19 pandemic related to economic and health displacements.

Top 7 Most Energy Impoverished States

State Abbreviation	LMI Energy Burden	Non-LMI Energy Burden
AK	42.4%	24.5%
ME	40.4%	28.0%
VT	27.2%	19.3%
MS	26.7%	8.3%
HI	23.1%	6.4%
SC	22.0%	7.3%
AL	20.9%	7.2%

Energy Stressed and Energy Burdened States

State Abbreviation	LMI Energy Burden	Non-LMI Energy Burden
OH	10.0%	6.3%
MT	9.8%	5.3%
TX	9.2%	4.4%
MN	9.0%	5.9%
WI	9.0%	5.8%
IN	8.8%	5.8%
NJ	8.3%	6.0%
NV	7.9%	5.3%
NE	7.8%	4.7%
CO	7.8%	3.8%
WA	7.3%	4.3%
IL	7.2%	4.1%
DC	7.1%	1.8%

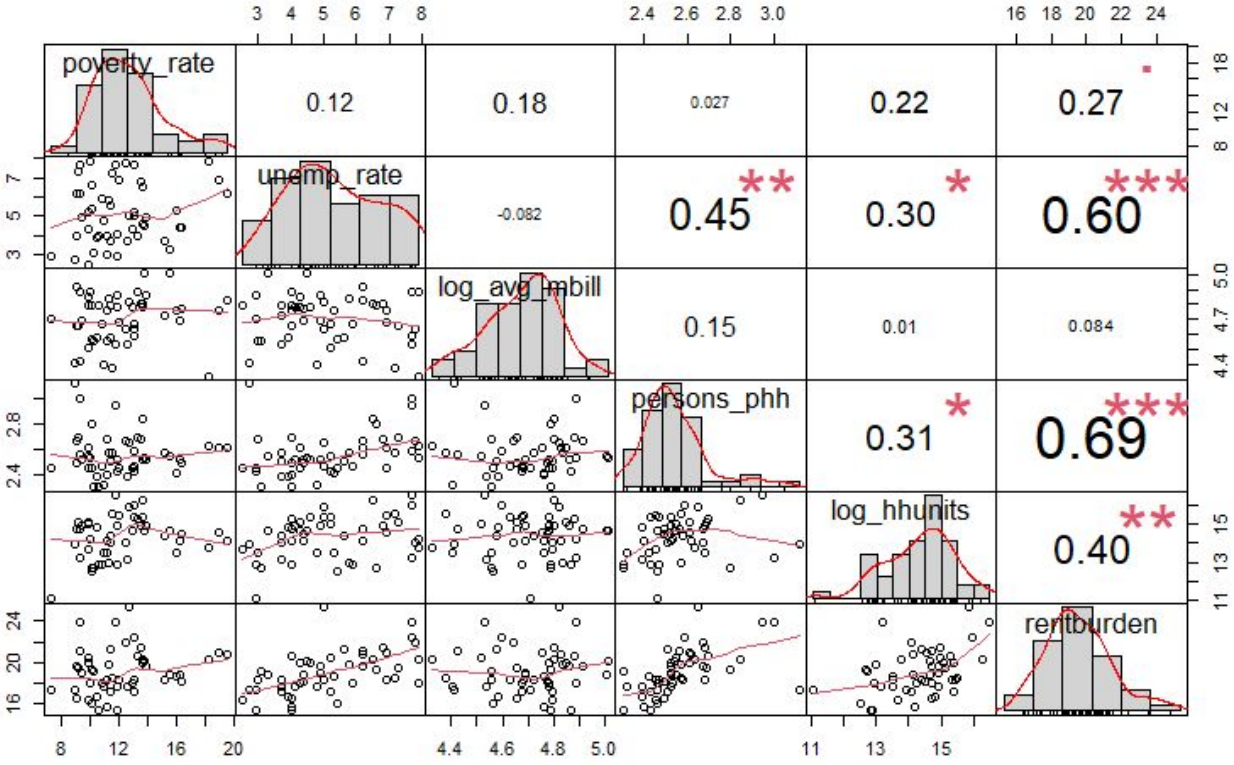
Rural households have higher energy burdens than urban households with the same incomes and situations.

- Rural populations bear larger energy burdens than urban populations with similar household incomes, household size, and racial composition due to less efficient, older and larger housing and less efficient appliances, among other factors.
- Statewide data for poverty or energy burden must be analyzed for this rural-urban differential.

Questions?

Data and Methodology

- Predictive modeling
- Specification
  - Dependent variable: energy burden - binary dependent variable
  - Predictor variables: state unemployment and poverty rates, persons per household, median household income, average monthly utility bill, housing stocks
  - Controls: demographic factors and statewide population.



Results

Model Coefficients of Energy Burden Determinants.

	Dependent variable: LMI Energy Burden >= 10.0, 1, 0		
	(Baseline)	(Demographics Weights = %AfrAm, %Asian & %Hisp)	(Controlling for Population, Weight = log (pop))
Poverty Rate	0.395*	0.458***	0.399***
	(0.221)	(0.042)	(0.057)
Unemployment Rate	0.282	0.362***	0.312***
	(0.333)	(0.075)	(0.088)
Log (Avg_monthly_bill)	6.899**	9.837***	7.161***
	(3.176)	(0.766)	(0.836)
Persons per household	-2.615	-5.453***	-3.140***
	(3.342)	(0.766)	(0.886)
Log (Housing units)	-0.664*	-0.750***	-0.666***
	(0.395)	(0.080)	(0.103)
Constant	-21.477	-27.786***	-21.531***
	(14.074)	(3.140)	(3.638)
Observations	40	40	40
Log Likelihood	-18.841	-468.473	-284.218
Akaike Inf. Crit.	49.683	948.947	580.435
Note:			*p<0.1; **p<0.05; ***p<0.01

Predicted Probabilities

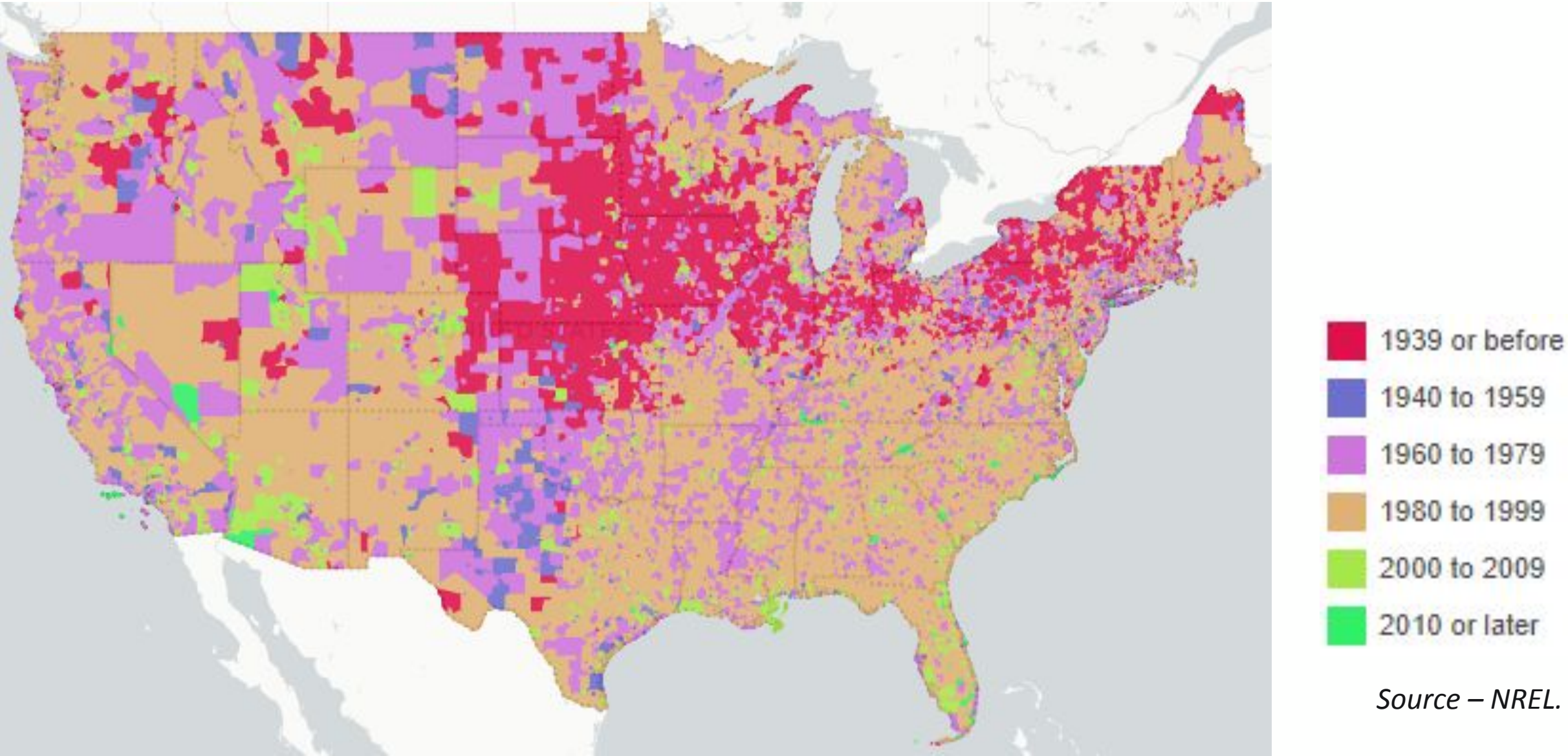
Predicted Probabilities of LMI Energy Burdens

	Dependent variable: LMI Energy Burden >= 10.0, 1, 0		
	(Baseline)	(Demographics Weights = %AfrAm, %Asian & %Hisp)	(Controlling for Population, Weight = log (pop))
Poverty Rate	0.597*	0.612***	0.598***
	(0.221)	(0.042)	(0.057)
Unemployment Rate	0.570	0.589***	0.577***
	(0.333)	(0.075)	(0.088)
Log (Avg_monthly_bill)	0.999**	1.000***	0.999***
	(3.176)	(0.766)	(0.836)
Persons per household	0.068	0.004***	0.041***
	(3.342)	(0.766)	(0.886)
Log (Housing units)	0.340*	0.321***	0.339***
	(0.395)	(0.080)	(0.103)
Constant	0.000	0.000***	0.000***
	(14.074)	(3.140)	(3.638)
Observations	40	40	40
Log Likelihood	-18.841	-468.473	-284.218
Akaike Inf. Crit.	49.683	948.947	580.435
Note:			*p**p***p<0.01

Contributors to high energy burdens for LMI households

- Available housing stock
- Availability of energy efficiency and weatherization programs
- Extreme temperatures
- Fees that disproportionately apply to LMI households

Number of Housing Units by Year Built



Source – NREL.

Utilities still charge the poor more.

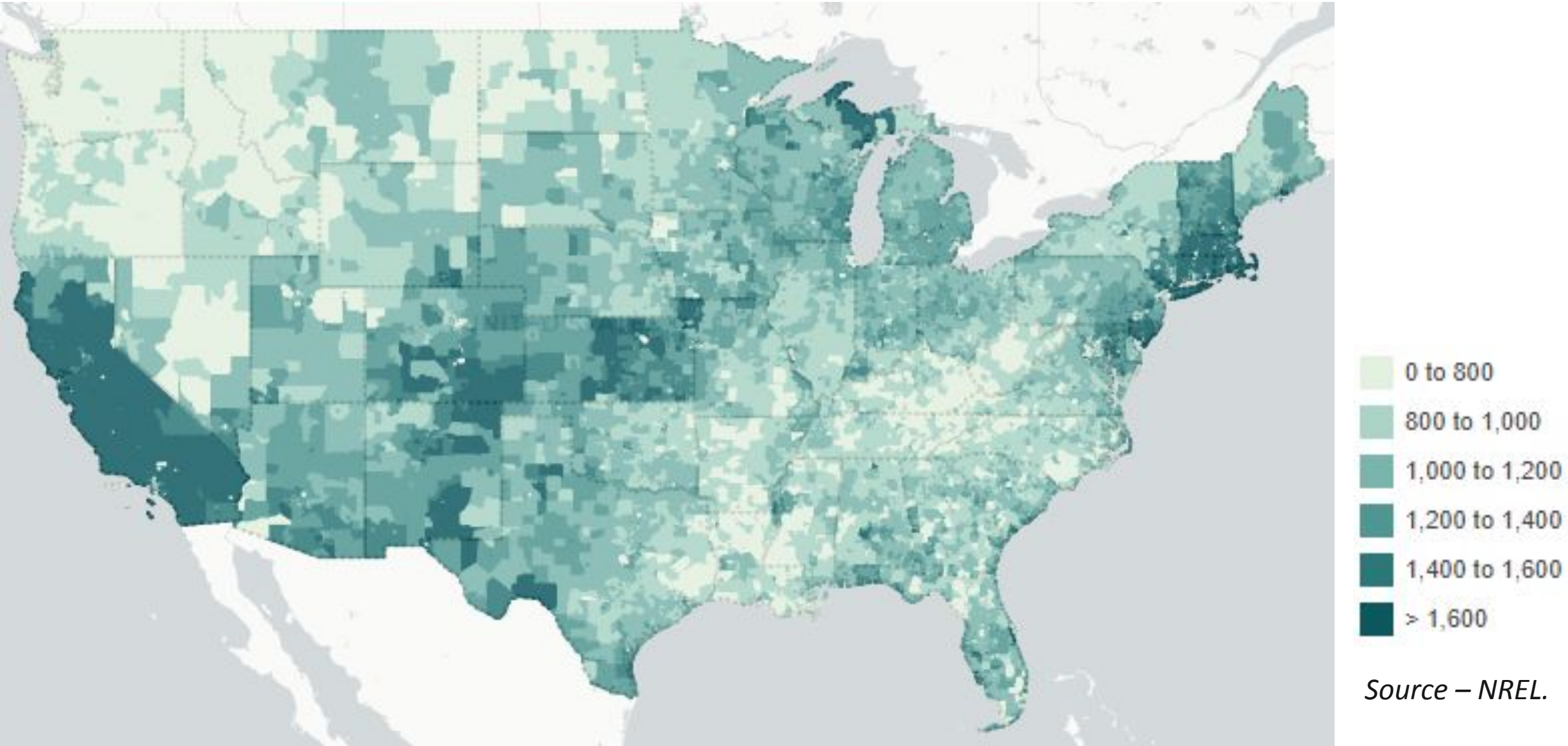
Despite the lack of proof for default rates, utility providers often charge different and higher ”up front” costs to low-income customers than the costs charged to more affluent households - forcing greater energy burdens on low-income households.

What is the solution?

Efficiency is a winner

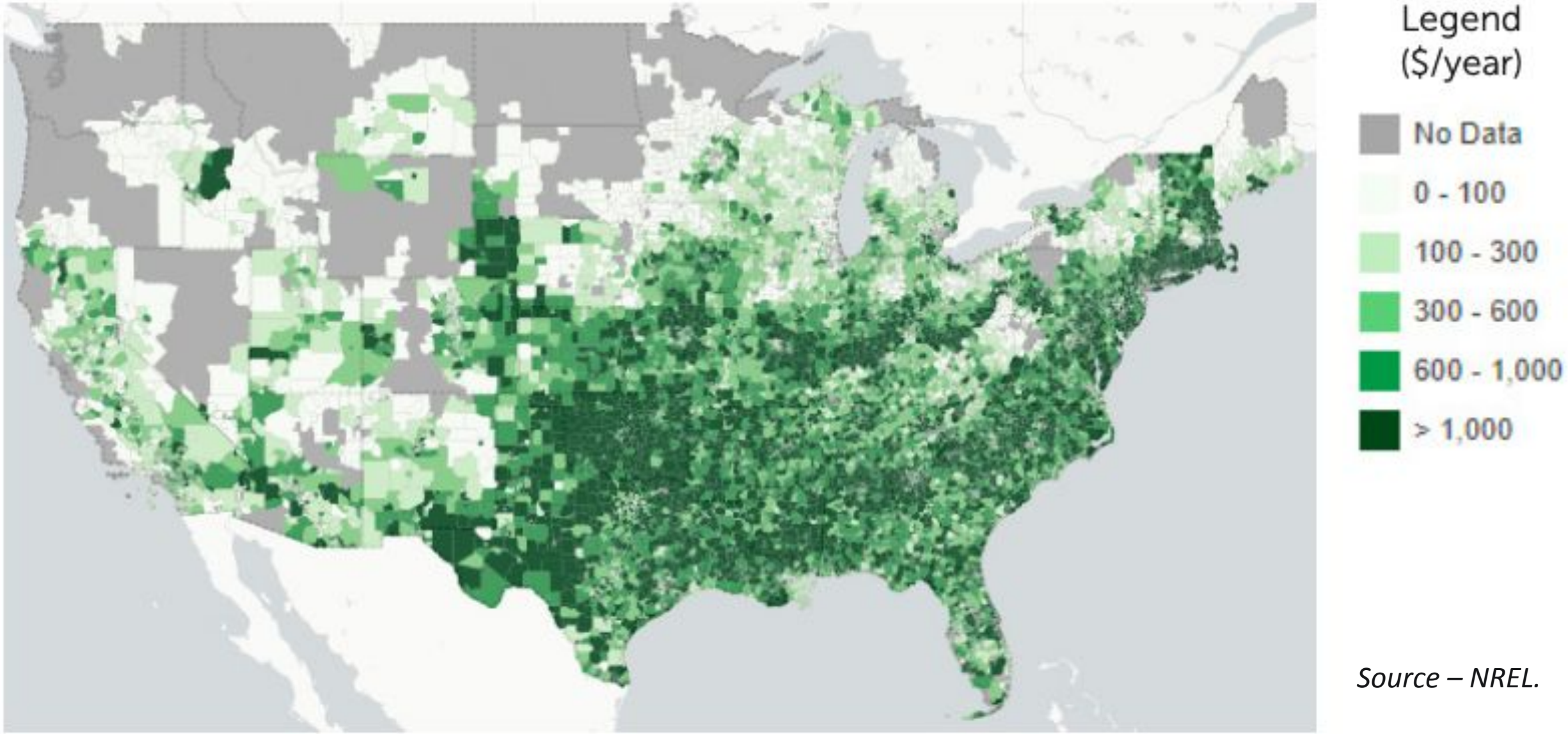
Efficiency upgrades with delivery of lower cost clean energy generation such as solar and wind would best correct inequities in energy burden levels nationwide.

LMI Potential Electric Bill Savings ($/year)



Source – NREL.

LMI (AMI) Energy Efficiency Bill Savings ($/year)



Source – NREL.

Conclusions

- Utility bills present a threat to the affordability of residential housing in the United States.
- Many low-income households are not able to meet their monthly living expenses due to high energy upfront costs — which utilities do not apply evenly to all customers based on income levels.
- Energy burdens can be reduced if utilities develop a framework where fixed charges are determined based on income.
- Energy efficiency programs focusing on LMI households should anticipate and address potential structural challenges in the housing itself.
- Energy burden may prevent low-income households from enjoying sustainable long-term economic growth.
- This study recommends that energy efficiency and assistance programs aimed at low-income households be prioritized as solutions to high monthly energy bills.

Questions?