U.S. DEPARTMENT OF ENERGY

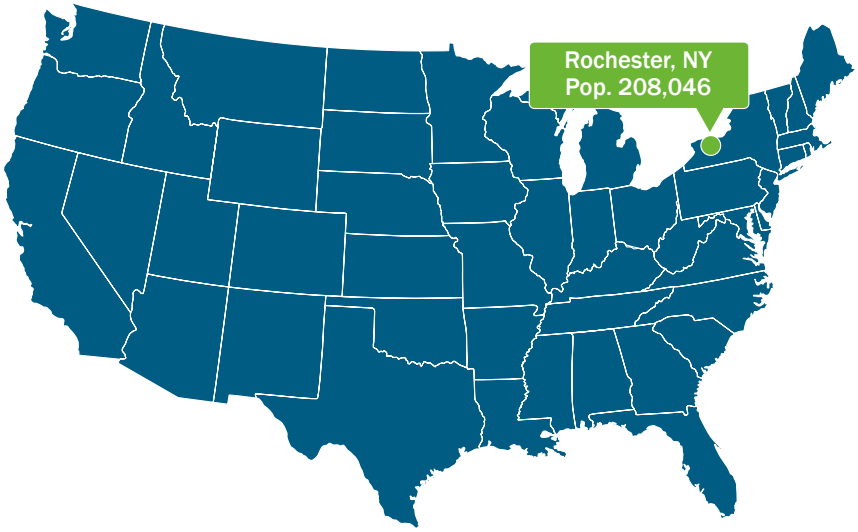
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Rochester, New York: Reducing Energy Costs for Low-Income Households

The City of Rochester partnered with the Energy Department and the National Renewable Energy Laboratory (NREL) to demonstrate how data and analysis can inform more strategic energy decisions. NREL based its analysis in part on the State and Local Energy Data (SLED) website's City Energy Profiles (eere.energy.gov/sled). The profiles contain data compiled by SLED and the Cities Leading through Energy Analysis and Planning (Cities-LEAP) program. Cities across the country can follow the same approach and use data-driven analysis in their own energy planning.

City Energy Goal

The City of Rochester, New York, has one of the highest rates of extreme poverty in the country. The cold, snowy climate and older residential building stock mean costly energy bills, particularly in the winter, that can lead to family destabilization as low-income renters sometimes move to avoid high energy bills. To help the Mayor's Office of Innovation and Strategic Initiatives focus on poverty alleviation while contributing to the greenhouse gas emissions reduction goals set by the Office of Energy and Sustainability, the city asked for data and analysis to target energy interventions to neighborhoods with the greatest need.



"The City of Rochester is committed to reduce greenhouse gas emissions and to revitalize city neighborhoods. NREL's detailed, localized energy affordability data and analysis available through the LEAD tool and SLED will assist us in demonstrating the importance of energy considerations in poverty alleviation and in more strategically targeting neighborhoods for future energy efficiency planning."

— Anne Spaulding, Manager of Environmental Quality

Data and Analysis

To conduct the analysis, NREL evaluated estimated city energy data available on SLED as well as analysis from the Low-Income Energy Affordability Data (LEAD) tool on OpenEI (openei.org/datasets/dataset/celica-data).

Understanding Energy Affordability

Rochester has a predominance of extremely low-income households in rental units (see Figure 1) compared to estimated state and national averages. The U.S. Department of Housing and Urban Development (HUD) determines low-income status as those households earning 80% or less of area median income (AMI) for a given location. HUD defines "very low-income" as households earning 50% or less of AMI and "extremely low-income" as those households earning 30% or less of AMI.[1]

Based on an analysis of HUD and U.S. Census data, extremely low-income households occupy approximately 41% of *renter-occupied* units in Rochester. Nearly 30% of *all* housing units (both renter- and owner-occupied) are occupied by extremely low-income households (see Figure 1).

For comparison, across the United States extremely low-income occupants account for a combined 15% of both renter-occupied and owner-occupied housing units. Similarly, in New York State, extremely low-income populations cumulatively occupy 18% of the state's total housing units.

Renters in Rochester are more likely to fall into lower income brackets than their homeowner counterparts. This situation is not uncommon among other cities where similar analyses have been conducted.[2] However, Rochester stands out in that the number of extremely low-income, renter-occupied households exceeds all other categories of households.

[1] State and county-level income limits are updated every fiscal year and are based on the number of people per household. Income limit documentation is available at https://www.huduser.gov/portal/datasets/il.html.

[2] See, for example, the Data to Decisions publication for Carrboro, North Carolina: https://www.energy.gov/sites/prod/files/2017/10/f37/Cities-LEAP_Data%20to%20Decisions_Carrboro%2C%20North%20Carolina.pdf.

Energy burden (the ratio of energy expenditures to household income) is a metric commonly used to assess the relative cost burden of energy expenditures on households. Of the approximately 80,000 housing units in Rochester, an estimated 24,000 housing units have an energy burden greater than 10% and 6,000 housing units have an energy burden greater than 25%.[3]

As Figure 1 indicates, 74% of low-income households in Rochester (80% AMI or below) live in buildings with four or fewer units, making multi-family efficiency interventions with economies of scale less effective in Rochester than many cities where large, multi-family buildings are more common.

Renter-occupied households have lower energy burdens than owner-occupied households in corresponding AMI categories in Rochester (see Figure 2).

Renter households across all AMI categories in Rochester, and most communities, have lower total annual energy costs than owner-occupied households. This situation may correlate with factors such as differences in unit area and household size, as well as shared walls and rental units that do not have separately metered utilities.

Mapping Energy Burden

To illustrate the geographic distribution of low-income households, the LEAD Tool data was analyzed and mapped by U.S. Census tract. To more precisely identify neighborhoods facing the highest energy burden, the tract-level energy burden data was fit to a log-normal distribution to estimate the number of housing units with a greater than 10% energy burden (see Figure 3).[4]

Understanding the geographic distribution of households with a high energy burden, as illustrated in Figure 3, may inform a more targeted approach for energy-related poverty alleviation interventions than simply targeting high-poverty neighborhoods or households.

Targeting Energy Interventions

Understanding how the housing characteristics of low-income households differ from the overall housing stock in Rochester may offer insights in developing more effective targeting of efficiency interventions. Low-income households in Rochester are more likely to live in renter-occupied, older (and therefore likely less-efficient) homes, pointing to energy savings measures as important poverty alleviation opportunities. Figure 4 shows that energy expenditures of extremely and very low-income households are similar to upper income households. For example, an education campaign might focus its resources on the two census tracts the mapping indicates

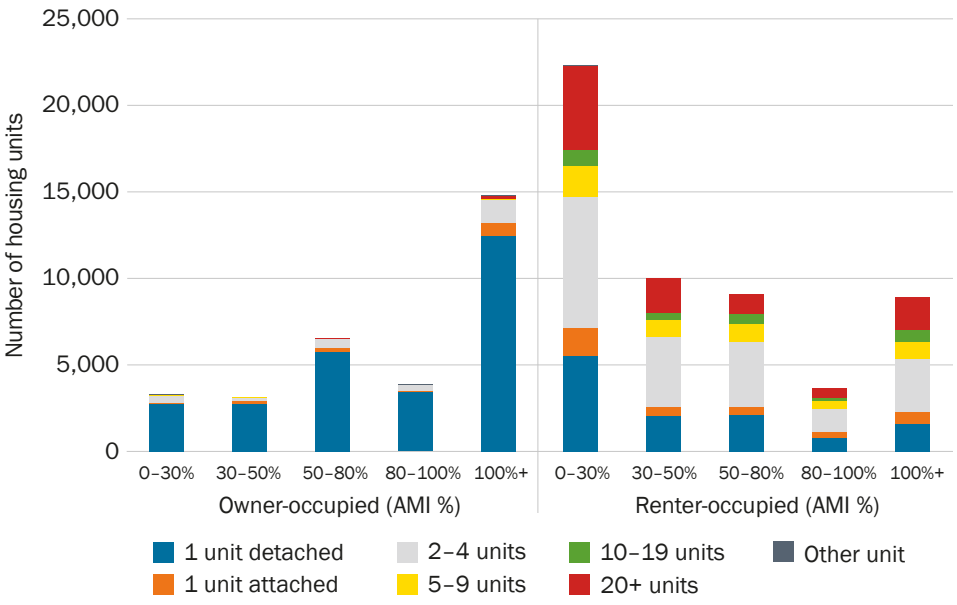


Figure 1. Number of housing units by housing type and area median income (2015) in Rochester, New York (Source: SLED[4])

Figure 2. Average energy expenditures and energy burden for residential sector (2015) for Rochester, New York (Source: LEAD tool: https://openei.org/datasets/dataset/celica-data)

[3] Estimates based on the LEAD tool data: https://openei.org/datasets/dataset/celica-data.

[4] Log-normal distribution is commonly employed in cases of skewed distributions where values, in this case energy expenditures, cannot be negative.

have both the highest concentration and percentage of households with a high energy burden.

In Rochester, the majority (81%) of all housing units rely on utility gas for heating, although an estimated 19% of renter-occupied units are electrically heated compared to approximately 4% of owner-occupied units.

An analysis of potential energy cost savings in single-family detached homes in each state, based on a detailed modeling of 350,000 representative individual houses using the ResStock tool, found that the following are the highest net-benefit measures in New York (see Figure 5):

- Upgrading electric furnaces to variable-speed heat pump (VSHP) at wear out
- Installing smart thermostats
- Upgrading to ENERGY STAR® clothes washers
- Installing LED lighting
- Replacing propane furnaces with VSHPs at wear out.

This research is summarized with fact-sheets on each state on the ResStock website (resstock.nrel.gov/factsheets/).

Additional measures to increase the efficiency of low-income and rental properties include the following:

- Time-of-sale efficiency requirements
- Rental and low-income weatherization programs
- Mechanisms to disclose anticipated utility bills to potential renters and buyers
- Requiring renovations to meet code
- Improving code compliance rates
- Adopting beyond-code measures (i.e., city policies that go beyond state-level or the latest vintage of building codes, such as the International Energy Conservation Code[5]).

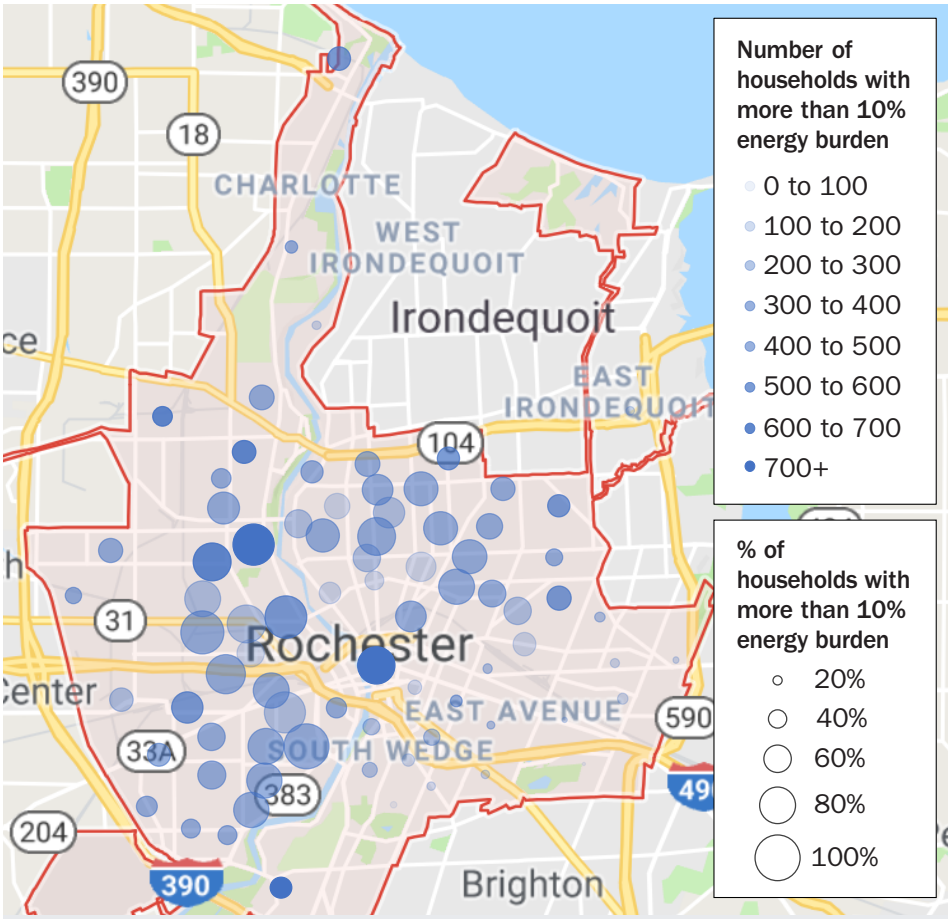


Figure 3. Estimated number of housing units with greater than 10% energy burden by U.S. Census tract in Rochester, New York. (Source: LEAD tool: https://openei.org/datasets/dataset/celica-data)

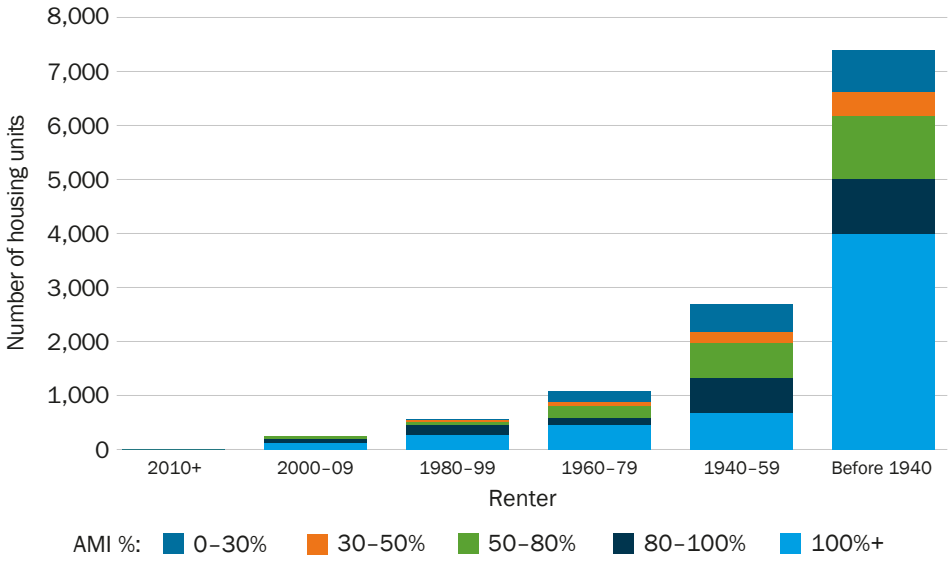


Figure 4. Number of renter-occupied homes by year built and tenant area median income level (Source: LEAD tool: https://openei.org/datasets/dataset/celica-data)

[5] International Energy Conservation Code Resource Page, International Code Council, https://www.iccsafe.org/about-icc/government-relations/international-energy-conservation-code-resource-page.

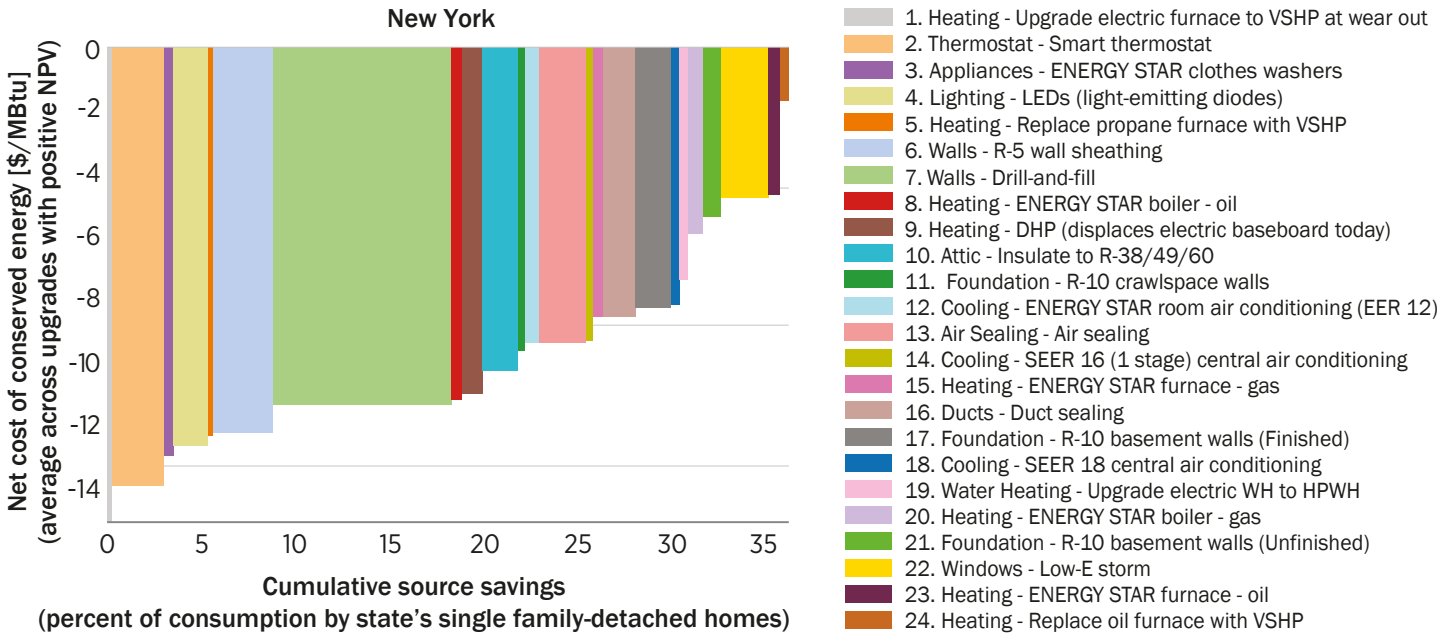


Figure 5. Energy efficiency supply curve for New York State. (Source: Data from E. Wilson et al., *Electric End-Use Energy Efficiency Potential in the U.S. Single-Family Housing Stock*, NREL [2017], https://nrel.gov/docs/fy17osti/65667.pdf). SFD = single-family detached; NPV = net present value; VSHP = variable-speed heat pump; DHP = ductless heat pump; EER = energy efficiency ratio (efficiency rating for room ACs); SEER = seasonal energy efficiency ratio (rating for residential central ACs); WH = water heater; HPWH = heat pump water heater.

Conclusions

Energy data such as the most cost-effective efficiency interventions and the geographic concentrations of households with a high energy burden can inform targeted programming to educate residents on energy efficiency opportunities and interventions. Clustering interventions can facilitate efficiencies from working with similar housing types and vintages. Characterizing the housing stock of low-income residents helps identify types of measures that can have the greatest impact in alleviating energy burden.

Resources

Low-Income Residential Energy Efficiency

- Better Buildings Clean Energy for Low Income Communities Accelerator: https://betterbuildingsinitiative.energy.gov/accelerators/clean-energy-low-income-communities
- Energy Efficiency in Affordable Housing, a U.S. Environmental Protection Agency guide for local governments: https://19january2017snapshot.epa.gov/statelocalclimate/energy-efficiency-affordable-housing_.html
- Low Income Community Energy Solutions: https://www.energy.gov/eere/slsc/low-income-community-energy-solutions

Renter-Owner Split Incentives

- Policy options for the split incentive: Increasing energy efficiency for low-income renters: http://www.sciencedirect.com/science/article/pii/S0301421512004661
- Report from the Rental Housing Energy Efficiency Work Group in Minnesota: https://www.cleanenergyresourceteams.org/files/RentalHousingEnergyEfficiencyWorkGroupDocument.pdf
- Guidance for Overcoming Split Incentives, from the City of Boulder, Colorado: https://www-static.bouldercolorado.gov/docs/Guidance_for_Overcoming_Split_Incentives-1-201602031712.pdf
- 8 Great Strategies to Engage Tenants on Energy Efficiency: https://www.energystar.gov/sites/default/files/buildings/tools/8-Great-Strategies-to-Engage-Tenants.pdf
- Working Together for Sustainability: The RMI-BOMA Guide for Landlords and Tenants: https://www.boma.org/sustainability/info-resources/documents/workingtogetherforsustainability.pdf
- Consortium for Building Energy Innovation – Creating an Energy Savings Win-Win for Owners and Tenants: http://cbei.psu.edu/split-incentives-and-green-leases

Find a cataloged, searchable list of more than 500 resources on the SLED Local Energy Action Toolbox: https://apps1.eere.energy.gov/sled/cleap.html. ■

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