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Residential Electric Space and Water Heating Market Characterization

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Prepared For
Commonwealth Edison Company

Prepared By
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EXECUTIVE SUMMARY

Overview of Purpose and Scope of Study

Commonwealth Edison Company (ComEd) is developing or seeking ongoing improvements for programs that encourage adoption of air-source heat pumps (ASHPs) as an efficient space heating technology and heat pump water heaters (HPWHs) as an efficient water heating technology. Customer bill impact calculations show a strong economic case for customers to install heat pumps when replacing inefficient electric resistance heating systems. To inform ongoing program design considerations, Slipstream conducted a market characterization of electric space and water heating in ComEd territory.

The goal of this effort was to characterize building types and customer types and differentiate geographic areas with sufficient resolution for ComEd to revise or create program designs that effectively migrate customers with electric resistance space and/or water heating systems to heat pump technologies. Within this goal, Slipstream characterized electric resistance space and water heating customers across several characteristics, such as home age and income. We further identified the geographic and building stock segments for ComEd to consider in energy efficiency (EE) planning and strategy.

To perform this characterization, we conducted two central lines of inquiry. We used public datasets, such as ResStock, American Community Survey (ACS), and Public Use Microdata Sample (PUMS), to create maps and summaries of buildings with these heating systems, with additional information on demographics and building stock. We then conducted interviews of local market actors to gain their ground-level perspective of these systems and associated buildings. Our findings and recommendations from this effort are summarized below and presented in detail within the report and appendices.

Key Findings and Recommendations

Heat Pump Retrofits

Key Finding	Implication	Recommendation
Heat pump retrofits for electric heat sources are attractive	In terms of economics for customers, cost-effectiveness, and ease of swapping systems, ASHPs and HPWHs are a clear benefit to customers with existing electric resistance systems, with a payback in roughly 5 years. The direct contrast in pure electric efficiency means that customers will immediately save both money and energy regardless of utility rates.	Offer an incentive to displace electric resistance in space and water heat: ComEd should consider program design adjustments to emphasize electric resistance space and water heating to heat pump equipment, such as with increased incentives, customer targeting, or increased advertising for this retrofit type.
Electric resistance systems are cheap and easy to replace	Interviews revealed that contractors replace electric water heaters and electric resistance baseboard systems with the same technology because it is cheap and lasts a long time, creating a barrier to displacing it. Similarly, ER baseboard systems are made up of individual, separate heaters, which often fail and are replaced one unit at a time. These justifications are misaligned with long-term customer cost savings.	Promote additional contractor education: As suggested in the propane report[1], reach out to relevant contractors or community organizations to ensure they're well-trained with the ComEd training materials in how to switch from electric to heat pumps and the benefits of doing so, along with best practices (e.g. HPWH ducting, ASHP operation with electric baseboard as backup).

[1] Slipstream Inc. (2023). "Propane Space Heating: Final Report."

Multifamily Buildings

Key Finding	Implication	Recommendation
High electric space heat prevalence within downtown multifamily buildings	The greatest prevalence of electric space heat is within multifamily buildings in downtown Chicago, and particularly large multifamily buildings built in the 1970s and 1980s. There are roughly three times as many multifamily housing units compared to single family units with electric space heat in the ComEd territory as a whole.	Target downtown multifamily buildings with a small suite of solutions: ComEd should identify and recruit multifamily buildings with electric space heat from downtown Chicago.
Multifamily building systems are varied	Among multifamily buildings with electric heat, public data suggests a nearly even mix of combinations of in-unit versus central heat and central AC versus no central AC. Central heat may be electric boiler or furnace systems, and in-unit heat is likely to be baseboard electric resistance. Buildings without central AC may have through wall air conditioners or no AC systems at all, and customers may or may not have existing window units. Contractor interviews, by contrast, suggest that most multifamily electric heat is in-unit baseboard radiators.	Multifamily programs should be prepared with a set of solutions that effectively address electric boilers, electric furnaces, and in-unit baseboard electric radiators, whether central or in-unit air conditioning is present or not. These programs should also anticipate how to use heat pumps for domestic hot water when space is constrained in units. Solutions could include alternative form factor heat pumps (e.g. window units), VRF systems, modular or packaged HPWH systems for boiler replacement, and combination space heat and DHW systems.

Key Finding	Implication	Recommendation
Inconclusive findings around electric resistance baseboards in multifamily buildings.	The data produced a discrepancy between contractors reporting seeing primarily electric resistance baseboard systems in multifamily buildings, while the quantitative data showed a more even distribution of system types. However, both data sources agree that in-unit baseboard electric resistance is at least the majority.	This discrepancy merits further research into the true proportions of electric resistance baseboard heat in multifamily buildings. Still, expect to tailor program interventions to existing electric baseboard resistance for most cases.

Single Family Homes

Key Finding	Implication	Recommendation
Electric resistance space heat is prevalent in older homes.	Both qualitative and quantitative data confirmed that the majority of homes with electric resistance heat were built in the 1970s and 1980s, when weatherization was not as widespread.	Older buildings heated by electric resistance are good candidates for heat pumps paired with weatherization.
Single family homes with electric heat are scattered	Single family homes with electric heat are rarer than multifamily homes, and clusters of high prevalence are distributed throughout all of ComEd territory besides downtown. Over 80% of these homes have existing central cooling which can be directly swapped for a ducted ASHP.	For single family, expect to displace electric space heat with ducted heat pump solutions: If ComEd intends to run a single family retrofit program for homes with existing electric heat, it can address over 80% of the candidate homes with an approach that anticipates a ducted air conditioner swap out.

Income-Eligible Customers

Key Finding	Implication	Recommendation
Geographic correlation with income for multifamily customers	The intersection of lower income tracts and high electric heat prevalence pulled out distinct pockets, particularly with multifamily customers. Income eligible multifamily customers with electric space heat were most prevalent in Cook County, with pockets in Waukegan and Rockford.	Efforts to increase heat pump program activity in multifamily buildings in Cook County, Waukegan, and Rockford should increase the representation of buildings with existing electric heat.
Weak geographic correlation with income for single family customers	While overall prevalence of electric space and water heat did not correlate strongly with income, income eligible single-family customers with electric space heat were most prevalent at the southern end of Cook County, with smaller clusters in Kankakee, Aurora, Rockford, and Rock Falls.	Efforts to increase heat pump program activity in single family buildings in the southern end of Cook County, Kankakee, Aurora, Rockford, and Rock Falls should increase the representation of buildings with existing electric heat.
Similar distribution of electric heating prevalence among income eligible and market rate customers	Within multifamily and single-family segments, market rate and income eligible segments have similar distributions of electric space and water heat and similar distributions of building age. Geographic segmentation picks out the discrepancies in income by neighborhood, and the segments themselves (MF and SF) have different ratios of income eligible to market rate customers.	While income eligible and market rate programs may have different incentives and outreach strategies, they can likely share elements of program design, especially as relates to prevalence of water heating given space heating type, and technology considerations based on existing systems and building stock. The market rate prevalence provides an opportunity for ComEd to obtain savings cost-effectively.

Electric Water Heating

Key Finding	Implication	Recommendation
Domestic hot water systems are often present with electric and propane heat	If a housing unit has electric space heat, an electric resistance domestic hot water system is highly likely. Propane and electric heat customers are the most likely to have electric water heat, but roughly half of the remaining electric water heat customers have natural gas space heat.	Promote HPWHs to customers with propane and electric heat: When customers with existing propane or electric heat participate in programs, they should be provided with HPWH retrofit program materials, either through their EESP or with follow-up targeted marketing. Particularly for single family homes with electric water heaters, advertising an incentive may be the best avenue to locate those customers.
Electric water heating is more common than electric space heat but is geographically scattered.	There are twice as many customer with electric water heat as electric space heat, but there did not seem to be clear geographic patterns. Moreover, the majority of electric resistance hot water systems are not in buildings with electric space heat.	Offer enhanced incentives to contractors and/or customers to swap from electric resistance water heaters to HPWHs, and promote these incentives broadly to motivate customers with existing electric water heat. Programs which can identify water heater fuel while on-site, such as weatherization, direct install, and heat pump retrofit programs, should provide a follow-up path to HPWH retrofits.