

WATER HEATING TECHNOLOGY POTENTIAL ASSESSMENT EXECUTIVE SUMMARY

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I.0 EXECUTIVE SUMMARY

ComEd commissioned this study to explore the opportunities to add a water heating program to its energy efficiency portfolio. The research considered commercialized water heating-related technologies that offer electricity savings but that are not yet widely adopted. It also explored the energy-saving possibilities from fuel switching that are newly possible with the passage of the 2021 Illinois energy law.¹

Research Objectives

The overarching research objectives were to:

- Identify water heating technologies with high unrealized energy-saving potential through a technical assessment;
- Characterize the current state of the local water heating market and supply chains and the potential for efficient water heating technologies within the market through a market assessment;
- Recommend the most promising technologies for potential ComEd program offerings; and
- Develop an implementation strategy for ComEd to promote the list of recommended technologies through a strategy development process.

Methodology

The study approach consisted of the components and activities listed in Table 1 below.

Table 1. Study approach components and activities

Component	Activities
Technical Assessment	Screening and review of available energy efficient water heating technologies Full review of potential energy savings for selected technologies based on ComEd data and Illinois Technical Reference Manual (TRM)
Market Assessment	Classification and sampling of plumbing contractors in ComEd’s service territory Telephone interviews and/or video discussion sessions with plumbing contractors, distributors, manufacturers, and end users Water heating supply chain characterization Peer utility program characterization
Strategy Development	Development of implementation strategy based on insights from market assessment

Summary of Findings and Recommendations

Four technologies rose to the top as showing the greatest technical electricity-saving potential for practical use cases:

¹ See Illinois Public Act 102-0662. <https://ilga.gov/legislation/publicacts/102/102-0662.htm>

- Unitary heat pump water heaters for replacement of electric resistance water heaters upon burnout (and for replacement of propane and natural gas water heaters in an electrification scenario);
- Tankless electric water heaters for point-of-service applications;
- Recirculation pump controls; and
- Refrigeration heat recovery systems in grocery and food service applications when the refrigeration and water heating systems are in close proximity.

Unitary heat pump water heaters offer sizable savings potential

Unitary heat pump water heaters offer by far the most substantial energy savings potential among these technologies. We estimated 570,000 to 650,000 total annual MWh in electricity-saving potential from replacements of existing electric water heaters with the majority of these savings existing in the residential sector. Moreover, electrification of existing propane and natural gas water heaters offers the equivalent of an additional 4,453,000 MWh in annual savings. In comparison, hot water recirculation pump controls provided about 63,000 MWh in total annual potential, refrigeration heat recovery provided 6,000 MWh, and tankless electric water heaters provided 2,000 MWh when applied in our modeled use cases.

For individual customers, purchase and installation costs are higher and lifetime energy costs are lower for heat pump water heaters than for electric resistance, natural gas, or propane varieties. Lifecycle costs are very favorable for heat pump water heaters over propane (by nearly a factor of two) and moderately favorable for electric resistance water heaters (by 20%) but not for natural gas using current modeling inputs and no incentives. However, actual lifecycle and operating costs are highly dependent on the evolution of installed equipment costs and marginal energy costs for electricity and the current water heating fuel.

Multiple market barriers stand in the way of heat pump water heater adoption

Most water heater installations are performed by plumbing contractors when an existing water heater fails. In these emergency replacement scenarios—and often also for scheduled installations—like-for-like replacement is the industry norm. New construction and planned remodeling projects that also involve mechanical systems are seen as more open to new technology, but here too, the market's tendency is to install the market standard: natural gas storage water heaters. The most common new technology advertised by some plumbing contractors is natural gas tankless water heaters, which offer some efficiency gains but are not as efficient as heat pump water heaters.

Table 2 lists barriers that need to be overcome for heat pump water heaters to gain traction in the northern Illinois market.

Table 2. Barriers to heat pump water heater selection by market actor

Plumbing Distributors	Plumbing Contractors	Home / Building Owners
Somewhat low familiarity	Low awareness	Low awareness
Stock technologies and models that are in demand	Discomfort with unknown technology	Substantially higher installed cost than standard options
Focus on natural gas water heaters over electric ones	Perceived risk of dissatisfied customers from unproven/unknown technology	Potentially long lead times for product availability, especially in emergency replacements
	Higher effort and cost involved in specifying	
	Higher risk	
	Reluctance to get involved in electrical work and uncertainty when it would be needed for heat pump water heaters	

Moreover, plumbers expressed reluctance to get involved in the administrative aspects of rebate processing or application completion that is often involved in midstream-oriented cost buy-downs by utility efficiency programs.

A beachhead approach or electrification focus provide possible entrées for ComEd

Despite the market barriers, we identified 23 utility programs that promote heat pump water heaters. All programs we reviewed use consumer-focused incentives, some with additional incentive and support at the midstream level.

We recommend either (or both) of two approaches to ComEd:

A beachhead approach would involve working with a small number of interested plumbing contractors who would be willing to promote and install heat pump water heaters for their customers. This effort would need to provide typical program elements, such as:

- Financial incentives to reduce the installed cost;
- Outreach support; and
- Technical training or support.

However, it would also require some initial efforts to reduce the perceived or actual risk to participating plumbers and logistical challenges, including:

- Guaranteed equipment availability through arrangements with distributors;
- Customer satisfaction guarantees that lower the risk to plumbers of potential callbacks;
- Incentives to cover the additional cost of specifying and installing units initially; and
- Enhanced technical support, including access to electrical installation assistance when needed.

Over time, these supplemental program elements can be lifted and replaced with encouragement to participating plumbers to share their experiences among their peers as well as ComEd efforts to share case studies and testimonials in preparation for expansion to a full-scale program.

This beachhead approach could also encompass new construction efforts, self-motivated consumers seeking climate-friendly or leading technology solutions, and remodel efforts that involve mechanical contractors. However, a focus on plumbing contractors will best serve efforts to instill awareness, familiarity, and comfort among the plumbing industry that is involved in the vast majority of water heater installations.

An electrification approach has become increasingly feasible through passage of the 2021 Illinois energy law. We suggest consideration of three potential paths as ComEd explores its strategy on electrification generally:

1. Use heat pump water heaters offered as part of a water heating program as an initial effort toward electrification of homes and commercial buildings with residentially-sized equipment, with follow up as heating systems fail.
2. Include heat pump water heaters as part of whole-home and whole-building electrification measures. In this case, the heating system will take primary importance, so this effort would be external to—or in cooperation with—ComEd’s water heating program.
3. Focus on electrifying failing and poorly performing water heaters in income-qualified homes as a way of proving the technology to the market while accumulating energy savings associated with low-income homes, which are required by the 2021 Illinois energy law to total at least 25 percent of total electrification savings.

Commercial sector water heating would be part of either a beachhead or electrification effort for buildings that use residentially-sized equipment. For commercial buildings with commercially-sized equipment and those with high volume capacity needs, ComEd could offer separate incentives and support of high-volume commercial heat pump water heaters to commercial installers, which are often mechanical system contractors.

Recirculation pump controls and electric tankless could complement a program
Recirculation pump controls and electric tankless water heaters for point-of-service applications offer far less savings potential but provide an opportunity to round out heat pump water heaters for a more complete program offering. We recommend:

- Working with manufacturers’ direct-to-customer sales and with big box retailers to promote controls to customers with domestic hot water recirculation pumps regardless of water heating fuel; and

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- Promoting electric tankless water heaters for point-of-service applications, where applicable, but not for whole building water heating that could be served by heat pump water heaters.

Meanwhile, refrigeration heat recovery shows potential, but would be better positioned as an offering by a refrigeration program or a sector-specific program that targets grocery stores and food services.