

Integrated HVAC Controls: What We Are Learning From Early Adopters

To reach our industry's ambitious carbon reduction goals, technology has to work for the environment and for people. ILLUME explores how integrated controls foster beneficial electrification and what contractors and residents need to adopt these technologies.



The Challenge

Many residents rely on heating systems that burn oil or propane delivered to their homes or on electric resistance heating (e.g., baseboard heaters). A Northeastern state government offers rebates for residents to upgrade their heating systems to more energy efficient central heat pumps (HPs) or ductless mini-split HPs. The program also offers a rebate to encourage residents to adopt integrated controls to operate their systems efficiently. ILLUME helped our state government client understand:

- *How satisfied are customers with the program and how can the program improve?*
- *What motivates customer decision-making around their equipment purchase?*
- *How are customers controlling their existing and new HP systems?*

APPROACH BY THE NUMBERS

1700+

homes billing analysis

40

sites metering analysis

3

baseline building model calibrations

325+

person customer survey

18

contractor interviews

4

distributor interviews

6

group interviews with program sponsors and staff

How We Did It

To provide these insights, ILLUME used in-depth interviews and survey research to learn from the market, reaching out to stakeholders across the state.



Example **customer** questions:

Where did customers first learn about the rebate they received for their equipment?

What was customers' main reason for installing the equipment?

How did customers learn about the equipment they had installed?

How satisfied are customers with the overall contractor experience?

Has the customer or anyone else changed the integrated control switchover temperature setting since it was first programmed?



Example **contractor and distributor** questions:

How did contractors discuss HPs and integrated controls with their customers?

What was contractors' installation process for HPs and integrated controls?

What barriers did contractors face installing the technologies?

What observations have distributors made about fuel displacement technologies?

Our team also performed detailed analyses to refine our client's program impact measurement. We applied industry best practices to reduce variability and increase consistency in measuring program impacts, including baseline building model calibrations. To learn more about energy savings analysis best practices, see our recent [white paper](#).

By hearing directly from stakeholders, states can improve EO program delivery and increase program impacts to optimize energy use.




The Results

Our team performed several research tasks, including a customer survey and staff and stakeholder interviews. We learned that, overall, the program is having the intended effect of customers upgrading to a more energy-efficient HP; customers are satisfied with their new equipment; and significant opportunity exists to improve the program. We learned:

The technology presents challenges to customers, leading to manual operation.

- About half of customers with mini-split HP installations manually operate their systems, which potentially may reduce efficiency benefits.
- Customers do not use standardized switchover temperatures and instead toggle between their new HP and old fuel-delivered systems in ways that may not optimize energy use.
- Integrated controls may vary widely in functionality and features by manufacturer and may overwhelm installers and contribute to customers manually overriding controls.

Integrated controls present three common installation barriers. Contractors vary widely in comfort and expertise with integrated controls technology and face common installation barriers:

Barrier	Description	Result
Connectivity issues 	Wi-Fi coverage can be spotty in homes, with limited coverage in basements where fossil fuel systems are located Signal interruptions can cause system errors or lockouts and result in customers losing heat	IT issues can be time-consuming and expensive for contractors and cause customer callbacks
Mismatched zones 	Zones for fossil fuel systems (typically just one zone) may not match the number of HP zones (mini-splits have one per room)	Customers may experience comfort issues such as overheating, which can prompt customers to override or disable the controls
Customer tech-savviness 	Some customers struggle with how to engage with the controls or phone application	Customers call contractors back to reprogram the system

Contractors who are early adopters use thoughtful solutions to overcome installation barriers. This group represents 20% of the population but performs 80% of installations and requires little to no technical assistance. Here are their solutions:

- Designate specialized staff to install the technology and field managers to troubleshoot issues
- Use diagnostic tools for Wi-Fi issues and provide modems or extenders
- Try different controls and identify the most user-friendly products
- Ensure capacity for customer callbacks

The Takeaway

Given that the integrated controls market is still developing, opportunity exists to:

Further study and train contractors and customers to install and operate the technology. Areas to pursue can include:

- **Study of integrated control products in the market**, including networked and hard-wired, over a range of weather conditions (e.g., HP performance at lower outdoor air temperatures). This study may help refine program requirements and which products to include in the program.
- **Guidance to contractors** that compiles insights from early adopters and the product study. Include information about which controls are good for different customer types (e.g., tech-savvy, “set-it and forget-it”) and the features and functionality offered.
- **Distributor partnerships** for contractor support and training. Consult with distributors on updates to program requirements and incentives to help develop the market.
- **Defined ideal switchover temperature settings** to help customers optimize energy consumption by using each system when most effective and efficient.

Tailor and deliver communications directly to customers to help increase program participation, improve use of integrated controls, and increase program impacts. Programs can provide:

- **Proactive information directly to customers about EO offerings** before their systems break.
- **Online training and other resources that summarize benefits** and basic tips on how to operate the new systems to maximize energy efficiency and cost savings.
- **Customized literature by system type:**
 1. Central HP: highlight efficiency of turning back the heating set-point or choosing the thermostat “away” setting instead of turning off the heat when away.
 2. Mini-split HP: focus on cost savings and ease of “setting and forgetting.”

Pre-approved contractor network. Moving forward, customers must work with an approved contractor to access fuel-displacement rebates. These contractors will have access to:

- Revamped training and educational materials to further support optimal equipment selection based on customer needs.
- Program-recommended integrated control programming guidelines and switchover temperatures.
- Enhanced customer education materials.

Integrate more quality controls. The program will implement more quality control checks on completed projects to ensure installation work quality and proper equipment functioning. Checks will cover proper equipment sizing and control programming, including switchover temperature controls.



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