

Make *the* Switch

How upgrading from a natural gas furnace or boiler to a heat pump has cut costs and carbon pollution for British Columbia homeowners.



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Credits:

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About this Summary Report

This report highlights key findings of a recent survey of British Columbia homeowners who converted their heating system from a natural gas furnace or boiler to an electric air-source heat pump. CityGreen Solutions, a service-based non-profit organization, conducted the survey to provide homeowners interested in following in their footsteps with “real world” information on what a switch from a natural gas furnace to an electric heat pump would mean for their energy costs.

This Summary Report also identifies a number of house characteristics and/or considerations that can help reduce energy costs for those who may be considering a new heat pump. RDH Building Science Inc., an international building science and engineering consulting company, analyzed the results. The Community Energy Association, a provincial charitable organization, also supported the survey outreach and is helping distribute the findings.

Methodology

Thirty-two British Columbia households participated in the survey, with 24 participants providing sufficient before-and-after natural gas and electricity bill data to qualify for the cost analysis. Of those, 16 homeowners live in the Lower Mainland and 12 are on Southern Vancouver Island, with the remaining located elsewhere in the province.

Participants shared their energy bills representing at least one year prior to and after their heat pump installation, as well as information on their home’s size and age, number of occupants, and qualitative data, such as their subjective observations on home comfort.

Because most participating homeowners are located in southeastern British Columbia, the findings are most applicable to that region.

Findings

Though the survey sample size proved relatively modest, findings validate previous studies concluding that most homeowners who switch from a natural gas furnace or boiler to an electric heat pump will lower their overall energy use and costs.

Further, while the analysis concludes that heat pumps in most cases lower household heating costs compared to natural gas heating, in the coming years heat-pump economics are likely to improve further as a result of scheduled increases to the federal carbon price.

Energy Costs

Most homeowners who participated in the study are paying the same, or less, in overall energy costs to heat (and now also cool!) their heat-pump-equipped home than they were when they operated a natural gas furnace or boiler.

Specifically, in 66% of participating homes, the switch from a natural gas furnace or boiler to a heat pump yielded similar, or lower energy costs.¹ Considering all participating households, those who switched from natural gas to a heat pump reduced their energy bills on average by 10%.

Carbon Pollution

British Columbia's grid electricity is overwhelmingly generated from renewable sources, while natural gas is a fossil fuel. For this reason, all but one of the study households either dramatically reduced or outright eliminated their greenhouse gas emissions after switching to a heat pump.

One homeowner who did not achieve a steep drop in carbon pollution reported that they continually operate their natural gas fireplace through the heating season. This participant was also one of the few cases where overall energy costs increased after their switch to a heat pump.

¹ The remainder of participants encountered slightly higher costs, with 12% of households finding an energy cost increase of more than 10%.

All other homeowners achieved greater than 50% reductions in carbon pollution. Fully-electrified households—that is, those without a natural gas fireplace or water heater—reduced their household greenhouse gas emissions more than 90%.

When averaged across all participating households, those who switched from natural gas to a heat pump reduced their monthly greenhouse gas emissions by 73%.

Future Carbon Tax Increases

Though the provincial carbon tax was \$50 per tonne of pollution at the time of our analysis, almost all new gas furnaces and boilers installed today will still be operating in 2030, when Canada's national carbon price is scheduled to reach \$170 per tonne. In applying the 2030 carbon price to the participants' current energy bills, our analysis suggests that a heat pump would be more cost-effective to operate for 88% of participating households.

Renewable Natural Gas

Provincial natural gas utilities are offering renewable natural gas to homeowners interested in reducing their household carbon pollution. At the time of this report, this fuel costs more than twice as much as conventional natural gas. In almost all (92%) of the households that participated in the study, the researchers conclude that a switch to a heat pump would achieve the same carbon pollution reduction, at the same or lower cost, than a subscription to renewable natural gas service.

After switching to a heat pump, fully-electrified households cut their carbon pollution by more than

90%

In **66%** of participating homes, the switch from natural gas heat to an electric heat pump resulted in the same, or lower, energy costs.

Ensuring a Cost-Effective Heat Pump Upgrade

In some cases, study participants noted that their heat pump installation increased their energy bills. These homes were, on average, older than the overall sample, and very few of these homeowners pursued insulation or air-sealing upgrades. This reaffirms that upgrades to a building envelope will improve a heat pump's performance, particularly in older homes.

In addition, several participants with higher energy bills reported frequently supplementing their heating with secondary sources, such as a natural gas fireplace or portable electric space heater. One participant stated that they needed this additional heating because, they believed, their heat pump installation contractor had undersized the new equipment. This underscores the importance of minimizing the use of secondary heating sources and using a qualified and experienced contractor who can properly size a system.²

The Importance of an Energy Evaluation

EnerGuide home energy evaluations help identify the best actions to improve a given residence's efficiency. The study found that participants who had completed such an energy evaluation were more likely to have completed at least one additional upgrade (76%) than those who did not have an energy evaluation (44%). By completing an EnerGuide energy evaluation prior to starting a heat pump project, homeowners may also qualify for federal government rebates and other incentives.

² To qualify for incentives under the provincial CleanBC program, a homeowner must use a qualified contractor. Visit betterhomesbc.ca for information.

In Their Own Words

At the conclusion of the survey, researchers asked participants for any parting thoughts. Here are a few excerpts.

“Natural gas furnaces seem like an extremely outdated technology in comparison to heat pumps, like still having a landline instead of a cell phone!”
– **Rebecca**, Victoria

“Go for it. Operating costs are the same or lower, it's great having the air conditioning in summer and we have to get away from gas to slow climate change.”
– **Harvey**, Vancouver

“I have talked with my neighbours about the benefits of heat pumps, and three are in the process of installing new systems. They were primarily interested in cooling due to the recent heat waves.”
– **Conor**, Vancouver

Key Takeaways

Our analysis of real-world residential energy data demonstrates that electric heat pumps are generally less expensive to operate than natural gas furnaces and boilers in Southwestern British Columbia.

Homeowners looking to install a heat pump should also consider addressing their home's efficiency by improving insulation or air-sealing to maximize the cost savings from their retrofit. A qualified and experienced contractor can help ensure the heat pump is properly sized and installed, to limit or eliminate the need for secondary or backup heating sources.

In addition to lowering home energy costs, heat pumps offer a number of co-benefits including air cooling, improved indoor air quality, and reduced carbon pollution.

Almost all participants responded that their heat pump was a better, or much better, overall heating system than their previous natural gas furnace or boiler. This suggests that heat pumps are performing well throughout the heating season across Southwestern British Columbia.

Overall, how does your heat pump compare to your previous natural gas system?

2.9% worse

47% better

50% much better

Summary of All Averaged Participant Data

		Before Heat Pump	After Heat Pump	Change	
Utility Bill Data (Per Month)					
Electricity	Quantity*	659.91	1,019.55	+54%	On average electricity consumption and costs increased...
	Cost	\$81.26	\$129.56	+59%	
	Carbon pollution	0.01	0.01	-	
Natural Gas	Quantity	1,445.67	333.90	-77%	...but natural gas consumption dropped.
	Cost	\$97.77	\$30.39	-69%	
	Carbon pollution	0.27	0.06	-77%	
Total	Quantity	2,100.65	1,352.11	-36%	...leading to a net reduction in the amount of energy usage and cost, and a big drop in household carbon pollution.
	Cost	\$178.47	\$159.89	-10%	
	Carbon pollution	0.27	0.07	-73%	

*Quantity of energy consumed presented as kilowatt hours or equivalent; carbon pollution presented as tonnes of equivalent carbon dioxide (tCO₂e).