

# 3500 Willow St.

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## Building at a Glance

Location	3500 Willow St.
Size	2400 ft <sup>2</sup>
Style	Early Vernacular
Built	1911
Heritage status	not registered
Retrofitted	2016
Approx. cost	\$20,000
GHG reductions	4.29 tonnes / year
Grant	\$1,650
Home Energy Rebate Offer, <sup>1</sup>	\$3,300

## Building Team

Owner	Anne & Soren Gantt
Contractor	Quinton Construction
Energy Advisor	City Green Solutions

## Energy Efficiency Retrofits

Insulation: basement, main floor & second floor

Draft-proofing: air leakage reduced 16%

Weather stripping  
Doors X 2  
Windows X 4  
Bath fans X 2

Gas furnace 96% AFUE

Gas on-demand hot water heater 0.95 EF



## 3500 Willow St. was a perfect candidate for the Heritage Energy Retrofit Grant.

When Anne and Soren Gantt heard about the Heritage Energy Retrofit Grant program, they thought the grant could help with updating their newly purchased single-family heritage home. Planning on bringing the electrical up to code and renovating the kitchen, bathrooms and basement suite, the Gantts decided to also make the house as energy efficient as possible.

The Heritage Energy Retrofit Grant is designed to provide support to homeowners for energy efficiency retrofits compatible with heritage character. The program allowed the Gantts to access valuable home energy evaluations and advice on which retrofits best suited their 1911 home. The Gantts also had access to rebates and grants for insulation, draft-proofing and high-efficiency heating systems.

The Heritage Energy Retrofit Grant targets heritage and character homes built before 1940 because they typically have the greatest potential to improve energy efficiency and reduce greenhouse gas (GHG) emissions. The average potential GHG emissions savings for a house built in Vancouver prior to 1945 is estimated at 4.65 tonnes per year where as the average GHG emission saving for a house built between 2001 and 2010 is estimated at 1.44 tonnes per year.<sup>(1)</sup>

3500 Willow St. was a perfect candidate for the Heritage Energy Retrofit Grant. By implementing several retrofits, the Gantts had the potential to reduce GHGs by an estimated 4.86 tonnes per year.

<sup>1</sup> Rebate calculated based on Home Energy Rebate Offer program terms as of Aug 2016.



# Background



## Early Vernacular Style Features

3500 Willow St. and its neighbour (above), built in the same early vernacular style, potentially after a local pre-fabricated design.<sup>(2)</sup>



gabled roof



bay window



porch columns



shingles

**B**uilt in 1911, 3500 Willow St. sits in a row of similar houses in the early vernacular style. Beyond cosmetic changes and a renovation in the 1980s, the house has remained relatively unchanged since its initial construction.

Although charming and livable, the house was in need of some significant

updates. There was knob and tube wiring still present and a previous owner's tinkering during a 1980s renovation had left the electrical unsafe; "There were extension cords plugged into more extension cords," recounted Anne. The home energy evaluation would later reveal more needed updates.



# Home Energy Evaluation

**A**s part of the Heritage Energy Retrofit Grant program, participating houses undergo two energy evaluations completed by a Certified Energy Advisor. Evaluations are used as a baseline to measure energy loss and GHG emissions before and after retrofits are installed. The evaluations also provide tailored recommendations for which retrofits will be most effective based on the home's performance.

An energy advisor from City Green Solutions performed the evaluations for the Gantts' home. The pre-retrofit evaluation highlighted the potential benefits of a number of retrofits including insulation, draft-proofing, window repair and replacement of the existing heating systems.

Assessment of the home's insulation showed several of the walls and floors had an R-value of zero, while a blower-door test, which measures the exchange rate of air within a house, gave a result of 14.44 air changes per hour (ACH) with an equivalent leakage area (ELA) of 500 square inches.

In a nutshell, 3500 Willow St. was performing like a house built in 1911. The original lath and plaster walls had never been properly insulated, letting heat and air pass unimpeded through the walls. As a result the house was uncomfortably cool and drafty in the winter. This placed extra stress on the aging heating systems. Insulation and draft-proofing measures went a long way to rectifying these issues.

## Terminology



### Blower Door Test

A blower door test is used to measure air changes within a structure. A powerful fan is mounted to the main door and pulls air out of the house, lowering the internal air pressure. Exterior air then flows into the house through openings to fill the lower pressure environment. At this point the house can be inspected for air leakages with a smoke pencil while a calibrated gauge measures the ACH and ELA.<sup>(3)</sup>

### R & RSI values

"R values and their metric equivalent, RSI values, are a way of labeling the effectiveness of insulating materials. The higher the R value or RSI value, the more resistance the material has to the movement of heat."<sup>(4)</sup>

ACH = Air changes per hour  
ELA - Equivalent leakage area  
GHG = Greenhouse gases





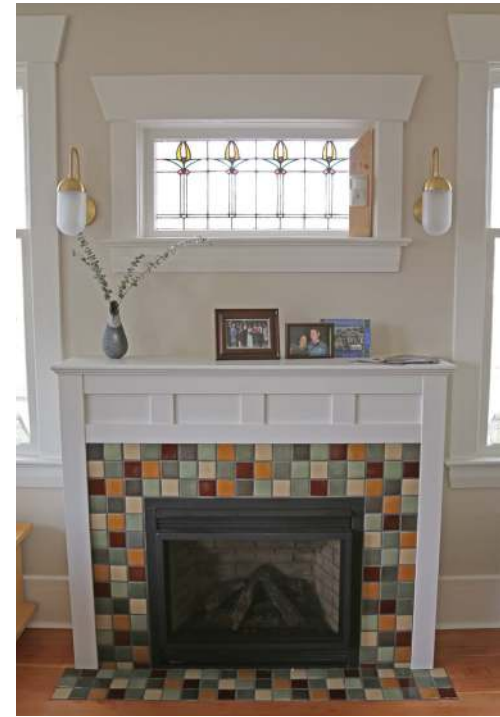
# Retrofitting the House

Over the course of a year, Anne and Soren installed several retrofits to make their home as energy efficient as possible. The Gantts added insulation in the basement and main floors to significantly increase R-values. The doors of the 1980s rear porch addition and four vinyl windows were replaced and drafty spots were sealed to reduce air leakage by 16%.

The Gantts also replaced both their furnace and hot water heater with more

efficient models, choosing a compact furnace with an Annual Fuel Utilization Efficiency of 96% and a tankless condensing hot water heater with a 0.95 energy factor.

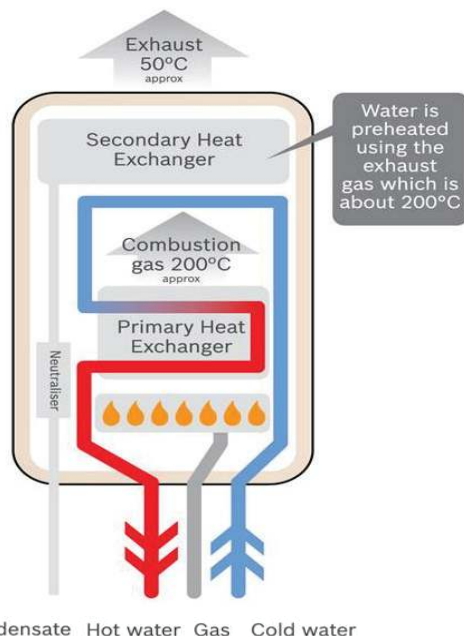
New EnerGuide gas fireplace (right). Although not original to the house, the fireplace echoes the original interior features. Note how the tile colours mirror the original stain glass windows above.



Location	R Value Change	Insulation Type
Second Floor	R0 --> R13.3	Blown-in loose fill cellulose
Main Floor	R0 --> R13.3	Blown-in loose fill cellulose
Basement	R12 --> R20	Spray foam
Flat ceiling under porch	R12 --> R28	Spray foam

The Gantts replaced their water heater with a 0.95 energy factor condensing tankless hot water heater (far right). Rather than storing hot water, this on-demand system only heats water when you need it, using high inputs of gas.<sup>(5)</sup>

The diagram (right), courtesy of Bosch, illustrates how an on-demand hot water heater is made more efficient by the use of condensation produced by combustion gases. The system uses the excess heat created by the condensation to reduce the amount of gas needed to heat incoming water.<sup>(6)</sup>



# Considering Heritage



Two custom crafted heritage-style wood frame windows were made for the Gantts' living room to match the originals in the room's prominent bay window.

Although energy efficiency, comfort and safety were motivating factors for the renovations, keeping in touch with the heritage features of the home was also very important to the Gantts. They worked closely with a local contractor who specializes in heritage homes. The contractor and a City Green Solutions Certified Energy Advisor advised the Gantts on how to retrofit their home while retaining character-defining elements.

Most of the home's original windows had been previously removed, so the Gantts chose to install thermal units throughout the home. Two new wood windows were installed in new openings on either side of the fireplace, complimenting the original bay window. As the home sits on a corner, they were permitted to add side windows facing the street. Original

features such as the wood floors that were uncovered in the renovation and the French doors that partition the main hall and the living room were retained. They also restored the porch which had been enclosed in a previous renovation.

The Gantts were careful to choose retrofits that were compatible with the existing heritage fabric. For example, insulation was blown into exterior walls via small openings to prevent damage to the interior lath and plaster walls of the main floors. As a result, 3500 Willow St maintains its turn-of-the-century charm while also being much more energy efficient.



The infilled porch (left) was opened up during renovations to restore it to its original appearance (right).





The Gantts are happy with the renovations and grateful for the financial support of the Heritage Energy Retrofit Grant.

## Conclusions

The Gantts' home is a great example of how heritage and character homes can contribute to sustainable development and reducing greenhouse gas emissions.

By installing several retrofits, the Gantts have reduced their home's GHG emissions by 4.29 tonnes per year. Had the Gantts opted to demolish their house and construct a new house of a similar size the total embodied energy lost and spent would have been approximately 3,367,440 MBTU, the equivalent of 30,000 gallons of gasoline.<sup>(7)</sup>

By retrofitting their existing character home, the Gantts have not only reduced their environmental footprint but also preserved part of Vancouver's history. Though not listed on the Heritage Register, 3500 Willow Street is still a valuable part of the city's heritage and adds to the neighbourhood's charm. The house remains part of a

distinct 1911 streetscape with two other similar houses on the small block, contributing to the character of the neighbourhood and connecting to its history.

The retrofit of this older home illustrates the valuable role older homes can play in Vancouver's sustainable development. Retaining heritage and reducing environmental impacts can go hand-in-hand. Older houses such as 3500 Willow St. demonstrate you do not have to build new to build green. Retrofitting houses is often a very sustainable choice.

To learn more about the Heritage Energy Retrofit Grant visit [www.vancouverheritagefoundation/heritage-energy-retrofit-grant.org](http://www.vancouverheritagefoundation/heritage-energy-retrofit-grant.org).

## Did you know?

Retrofitting older homes such as 3500 Willow St. is often more sustainable than new construction.

Several studies have shown that even over a 50 year period there is little difference in the cumulative GHG emissions of a newly constructed house and a retrofitted house due to embodied energy.<sup>(8)</sup>

Embodied energy is the total energy expended over a building's lifetime from construction to demolition.

Old buildings have the advantage that they were often built with local, less energy intensive materials. New buildings, on the other hand, have to make up for the energy spent during construction and for energy intensive materials like steel, vinyl and aluminum.<sup>(9)</sup>

# References

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# Canada

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