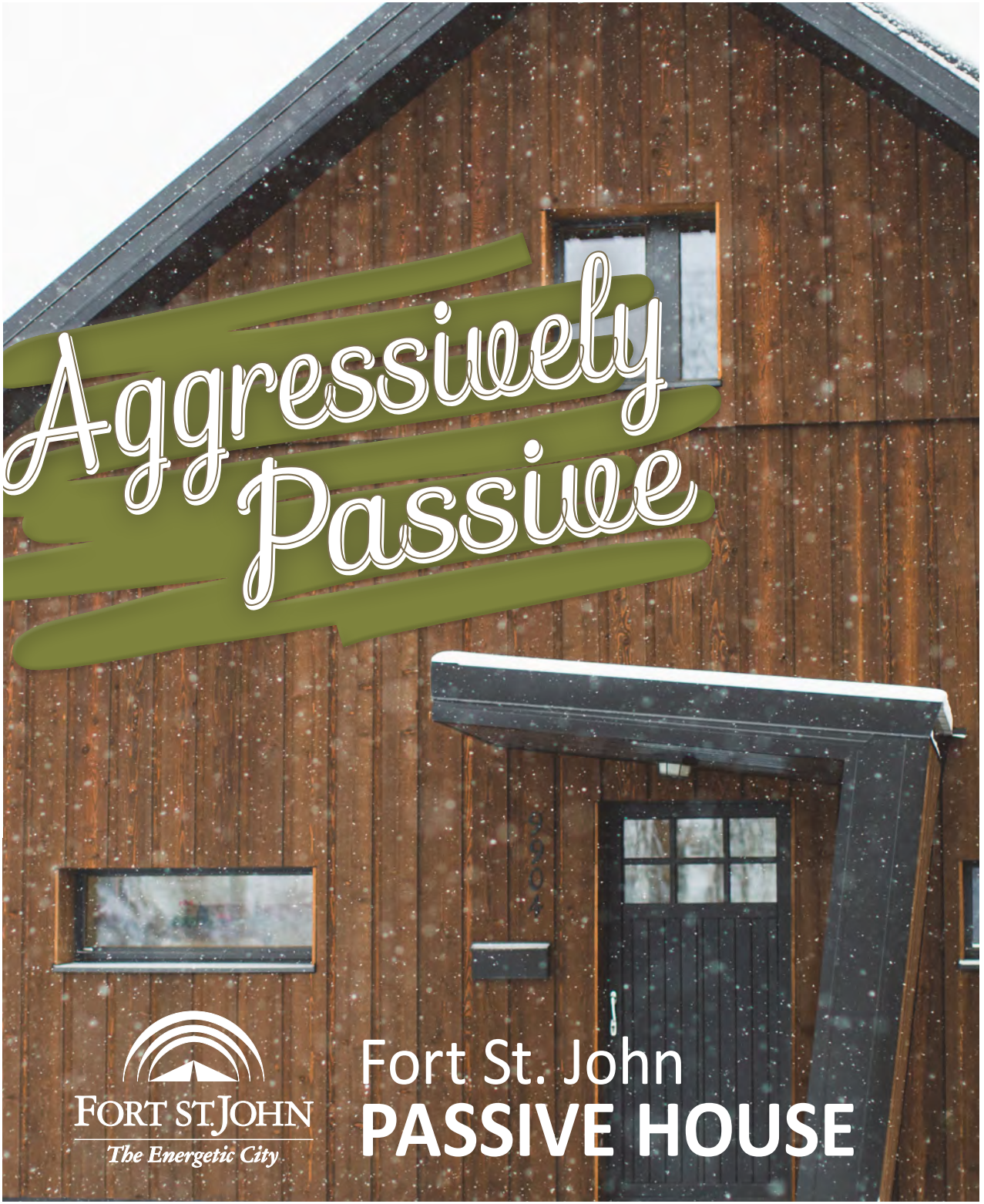

Aggressively Passive
9904
FORT ST. JOHN
The Energetic City
Fort St. John
PASSIVE HOUSE

WHAT IS A PASSIVE HOUSE?

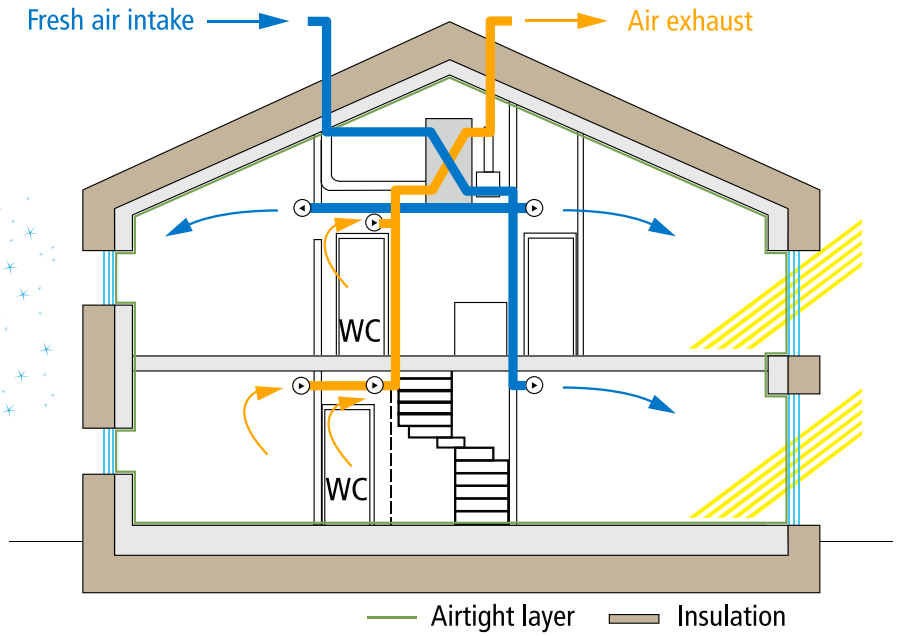
In a nutshell, a passive house is a house that is almost air tight, gets most of its energy from the sun and has such an efficient heating and cooling system that it only requires a small amount of energy.

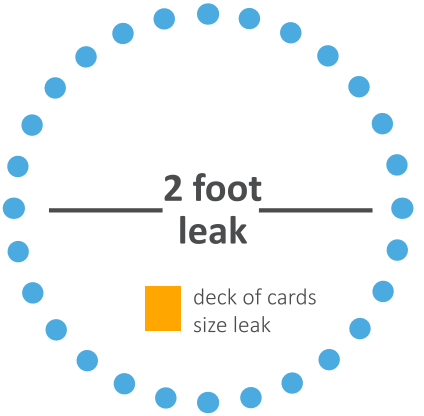
Energy performance savings of 80 – 90% happen with consideration of: proper planning, efficient building shape, solar exposure, super-insulation, advanced windows, airtightness, ventilation with heat recovery, and thermal bridge-free construction.

For a building to be certified as a Passive House, it must meet the following main criteria:

- Space Heat Demand: max. 15 kWh/m2a, or Heating load max. 10 W/m2
- Pressurization Test Result @ 50 Pa: max. 0.6 ACH (both over-pressure and under-pressure)
- Total Primary Energy Demand: max. 120 kWh/m2a

A Passive House is really a luxury home: they are so comfortable because there are no drafts and yet fresh air is always circulating.





25%-40% of heat loss in your home is from tiny air leaks in the building envelope.

In a standard home these little air leaks add up to the equivalent of a 2 ft. diameter hole in your house leaking 24 hours a day.

For comparison, our Passive House has a total air leak the equivalent of a 4 inch hole or a deck of cards.

LEED Platinum Certified

In 2017, the Fort St. John Passive House was awarded the highest level of LEED certification from the Canada Green Building Council. At the time of certification, the house was one of two single family homes in Canada to be awarded both Passive and LEED.

For more information about LEED visit: www.cagbc.org/LEED

THE CONSTRUCTION COSTS

Experts say that a passive house can be built for no more than 5% more than an average house.

The construction of the Fort St. John house and garage, at a cost of $276 per square foot, compares favourably with other average homes in Fort St. John. The average home cost in 2014 was between $250 and $350 per square foot depending on the finishing details chosen.

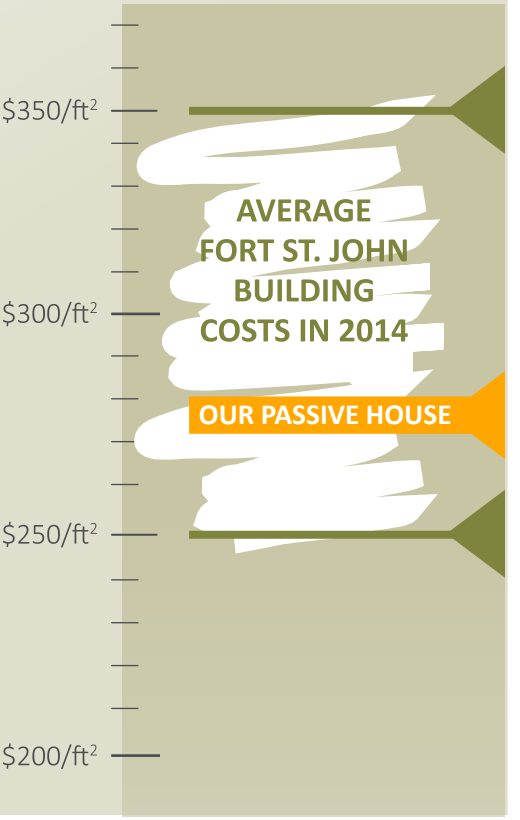
Costs were kept lower by choosing economical interior finishing options and there is some cost savings in not needing to buy a furnace.

Costs for utilities in the home have been minimal. The monthly savings for utilities makes a passive home comparatively inexpensive.

Power Outage? Not a problem in a passive house. Even in the coldest winter storm with no power from the solar panels a passive home temperature will not drop below 13ºC (55ºF) indefinitely.

Total floor area: 2155 ft²
Cost per ft²: $276.45

Excluding garage: 1897 ft²
Cost per ft²: $314.04

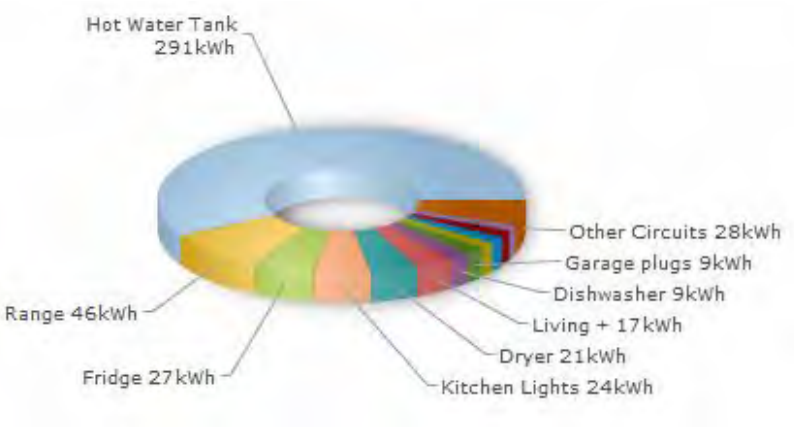


ENERGY USE & PRODUCTION

How do we know this Passive House is a success in the north? We monitor everything!

The PV (solar) panels and each circuit in the breaker panel are individually monitored. All of the data collected is presented back in a user friendly online dashboard to measure energy use and production. How much energy is produced and exactly where it goes is easily monitored

Electricity consumed in 30 days: Top 12 Circuits



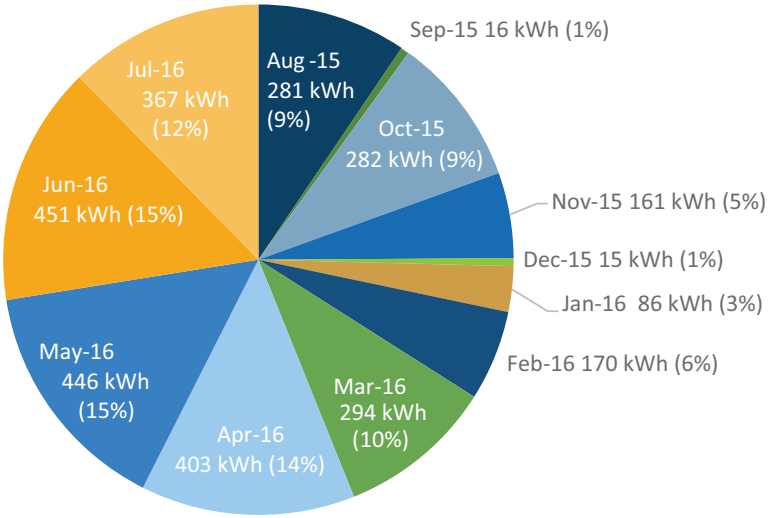
33%

of the Passive House energy costs are offset by solar energy production

Energy consumption

In an average house the furnace and hot water tank consume the most energy and in most houses that energy is natural gas. In this passive house there is no natural gas and there is no furnace. So what uses the most energy? The biggest energy user in the house is the hot water tank. In an average month it uses 301 KWh of electricity which is almost half of the energy needs of the house. The fridge (27KWh), stove (45KWh) and kitchen lights (24 KWh) round out the top four.

2015/16 energy produced by month (kWh)



Energy production

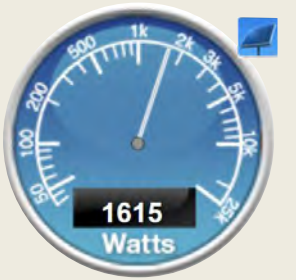
The coldest months saw the highest energy consumption and the lowest energy production from the solar panels. The production could be improved by making adjustments to construction so the solar panels do not get a snow build up or so that they are more accessible to be manually cleared.

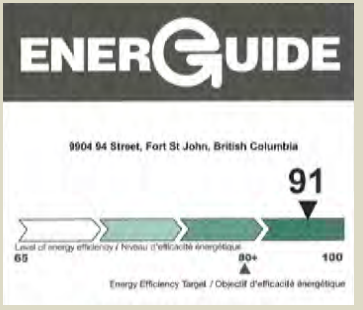
In the summer months more energy was produced than was consumed. Because that energy goes back into the BC Hydro grid it counts as a credit on the utility bill.

Utility meter

This green utility meter reading indicates that there is a surplus of energy being produced. When the meter turns red the house is using more energy than it is producing. The blue power production meter shows the electricity produced by the PV panels on the roof.

Energy production





Typical EnerGuide Home Energy Efficiency Ratings:

Natural Resources Canada certified the Fort St. John Passive House with an EnerGuide rating of 91 and projected that the home's annual energy consumption would be 16097 kWh.

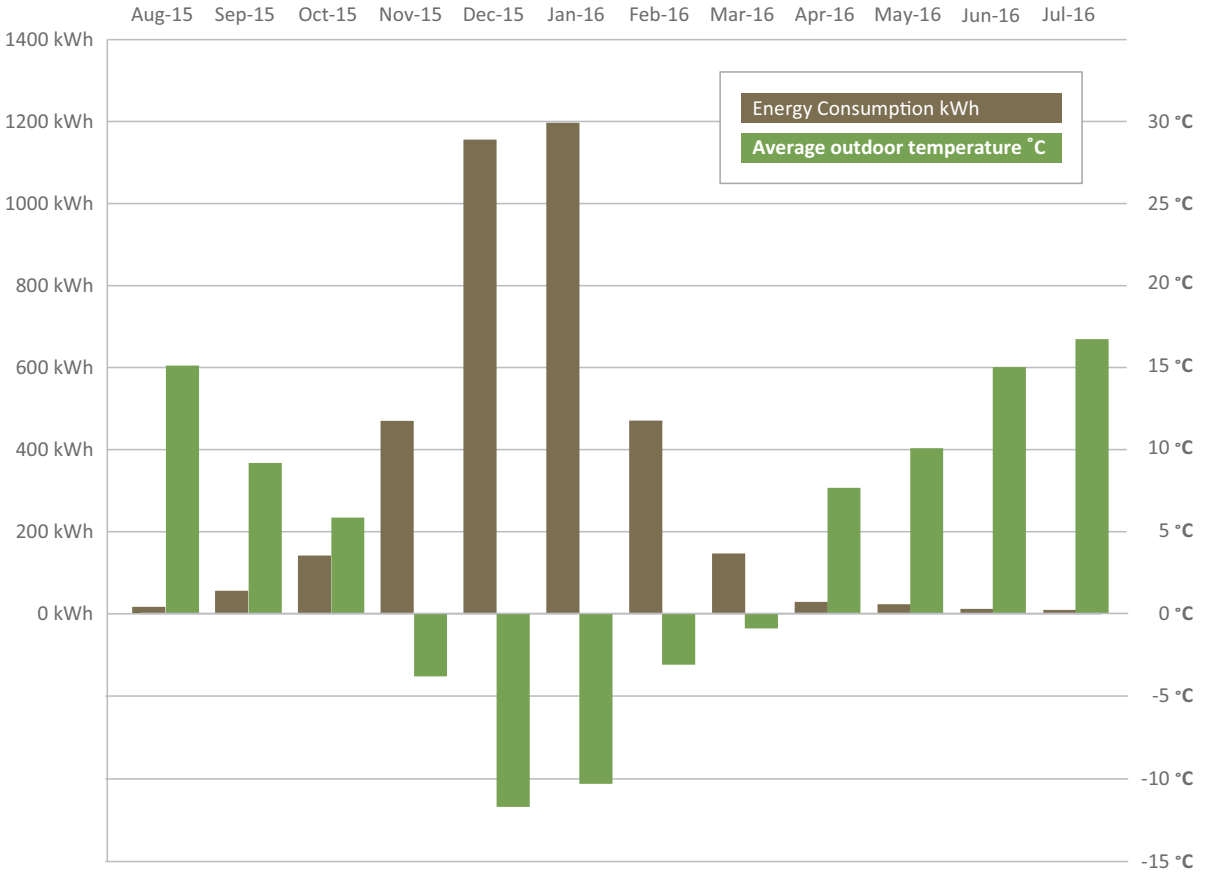
New house built to code standards..... 65-72
New house with some energy-efficient improvements..... 73-79
Energy-efficient new house 80-90
House requiring little or no purchased energy 91-100

THE LIVING LAB

Real people lived in the house for one year to give us real live data.

From August 2015 to September 2016 two caretakers lived in the home. They turned on the heat when it was cold, used the stove and the laundry facilities and accidentally left lights on – just like we all do. This produced real data based on real people.

Heating energy consumption vs. Average outdoor temperature

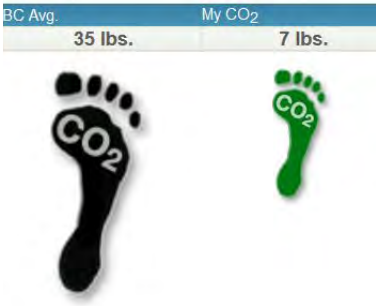


	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16
kWh	17	56	142	470	1156	1197	471	147	29	23	12	9
Avg ˚C	15	9.1	5.8	-3.8	-11.7	-10.3	-3.1	-0.9	7.6	10	14.9	16.6

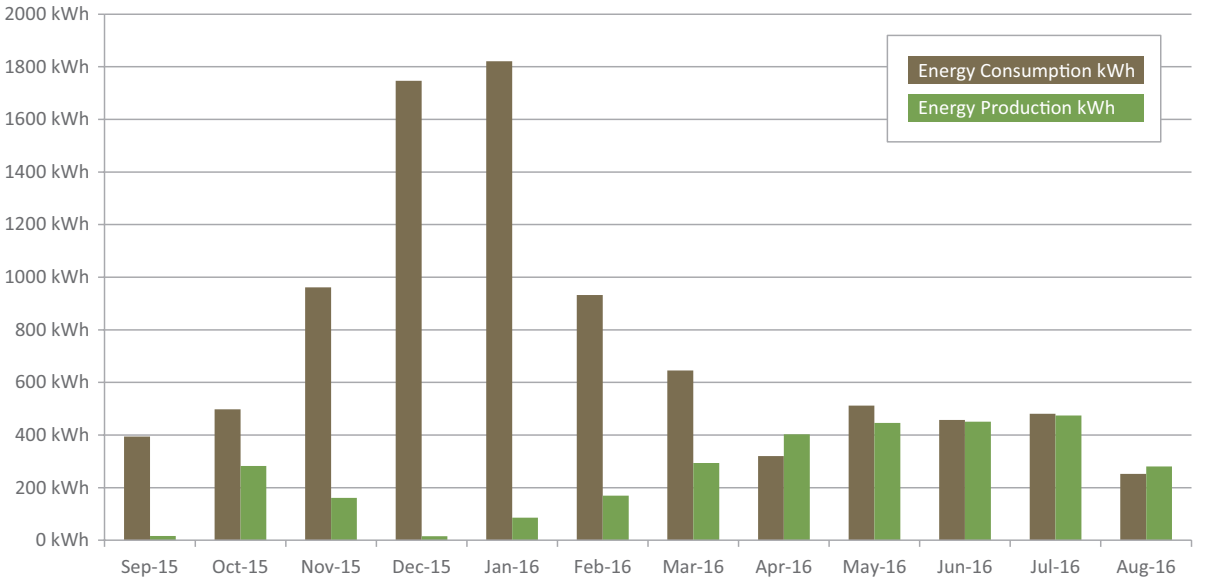
During this living lab experiment there were many public tours. Classrooms of children toured the house, open houses hosted dozens of people at a time and special groups booked private tours. They got to see the house and feel the temperature with the doors opening and closing and lots of people in the room. They experience first-hand the even temperature, fresh air and just how quiet the house is when a truck rolls by on the street.

What lessons did the caretakers learn? Close the curtains on hot days to keep the sun out, open the windows upstairs and downstairs on warm days to get better air flow and set the hot water tank to draw heat from the room to cool the house in the summer. Best of all, living in a house that has no dust and even temperatures is awesome!

30-day Carbon Footprint



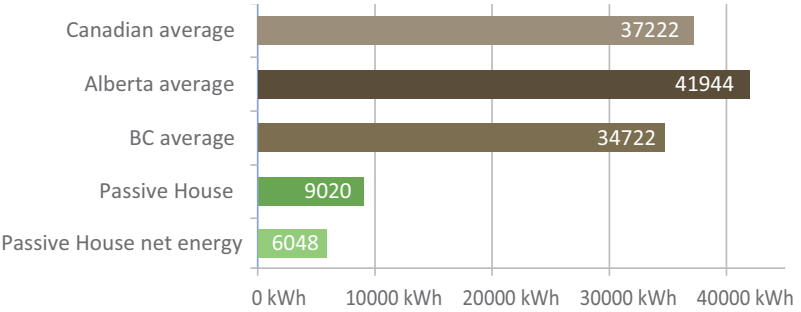
Household energy consumption vs. Energy production



Energy costs

In one year the house used 9020 KWh of electricity. At BC Hydro's 2016 rates this is equal to $747.76* or $62.31 per month IF there were no solar panels. With the power generated from the solar panels the monthly average cost for power would be $41.12.

Single family home energy consumption (kWh)



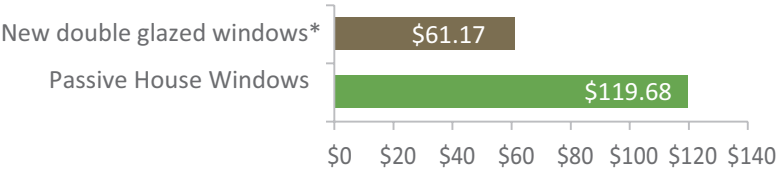
StatCan: 2011 Households and the Environment Energy Use

Fort St. John Passive House uses 84% less energy when compared to average home energy use across Canada

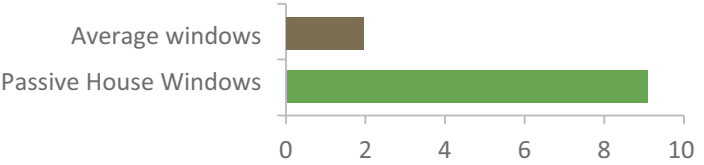
Windows

The windows, doors and walls are the most energy efficient features in the house. To compare apples to apples the passive house windows cost 51% more than an average double glazed window. But the passive house windows only lose 23% of the heat that the average window does.

Window price per square foot



Window R-values



** Quote received in Fort St. John, 2015*

Fort St. John Passive House windows are more than 4x more efficient than standard double glazed windows

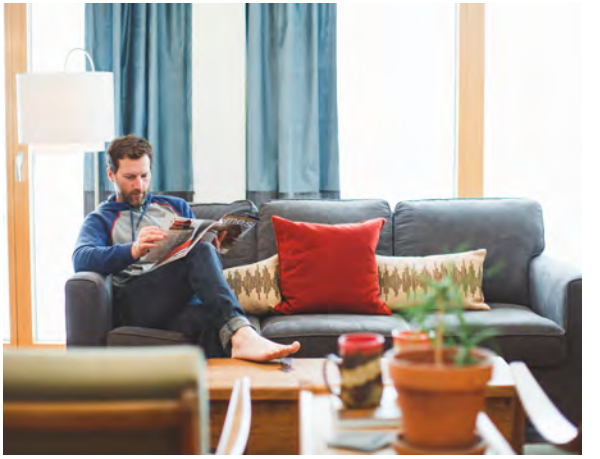
WHY BUILD ONE?

As the Energetic City, Fort St. John recognizes that an excellent source of energy is conservation. As an experiment on what can be accomplished in energy conservation – even in the north – the City embarked on a project to prove that homes here can be built to a high level of energy efficiency.

This single family residence is the northern most Passive House in North America and the 1st detached passive house in British Columbia.

Over the past several years, the City of Fort St. John has made it a priority to conserve water and energy, and ultimately reduce both costs and greenhouse gas emissions (GHG) from its corporate operations and at the community level. The Passive House project strategically fits with this "conservation first" approach as the Passive House standard is the most stringent energy efficiency standard for buildings in the world.

The Passive House serves as an example of the important role municipalities can play to introduce new ways of building and new technologies to citizens



The Fort St. John Passive House has:

- a heat recovery system that consumes 90% less heating and cooling energy,
- 99% reduction in greenhouse gas emissions (GHG's),
- extreme air tightness,
- net-zero energy readiness,
- air conditioning,
- a uniform temperature throughout,
- metal roofing,
- a solar electric array,
- high efficiency tilt/turn opening windows,
- hybrid electric heat pump hot water tank, and
- energy monitoring equipment

UPDATED OCT 2018

FORT ST. JOHN
The Energetic City

For additional information about this project visit
www.fortstjohn.ca/passive-house-project
or email economicdevelopment@fortstjohn.ca