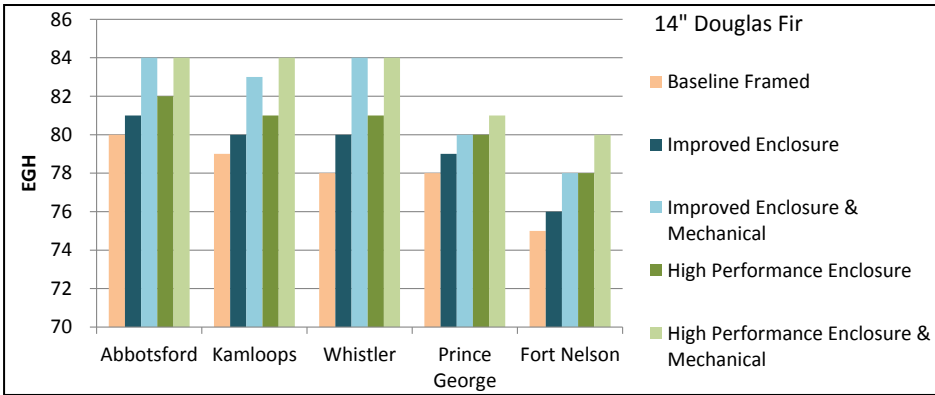
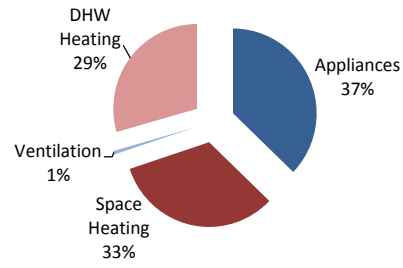
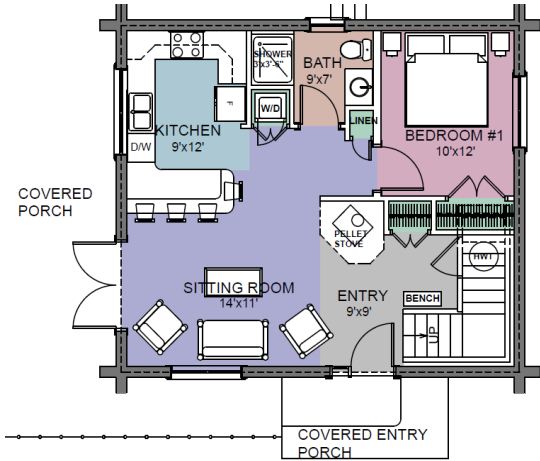
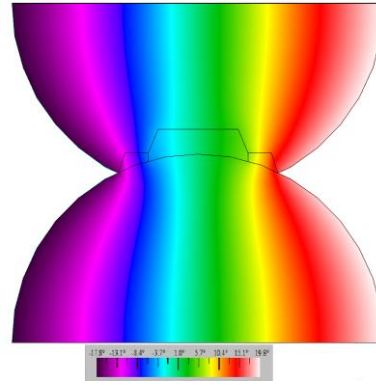


# Building Enclosure & Energy Performance of Log & Timber Homes

## Appendix C: Complete Energy Simulation Results



PREPARED FOR: BC Log and Timber Frame Home Market Expansion Project

SUBMITTED BY RDH Building Engineering Ltd.  
 224 West 8th Avenue  
 Vancouver, BC V5Y 1N5  
 Canada

PROJECT NUMBER 5197.10

DATE April 29, 2013

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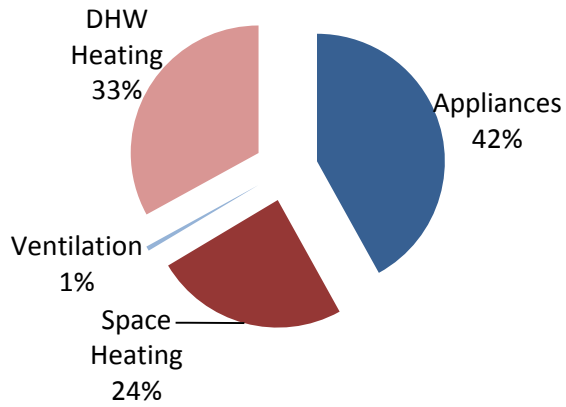
Archetype 3 Results

## 1.1. Archetype 1 Results

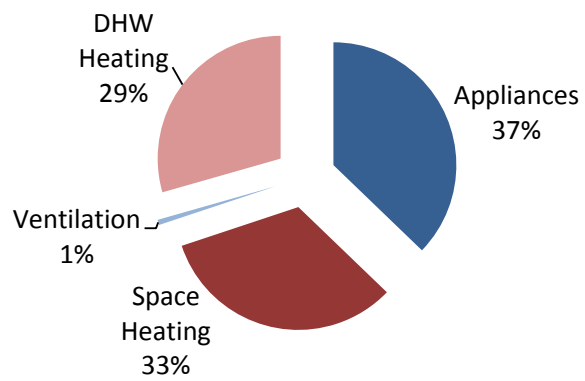
### Energy Consumption of Baseline Framed House

The following plots show the distribution of energy consumption, and the energy use intensity (kWh/m<sup>2</sup>) of the energy simulation for the baseline framed house.

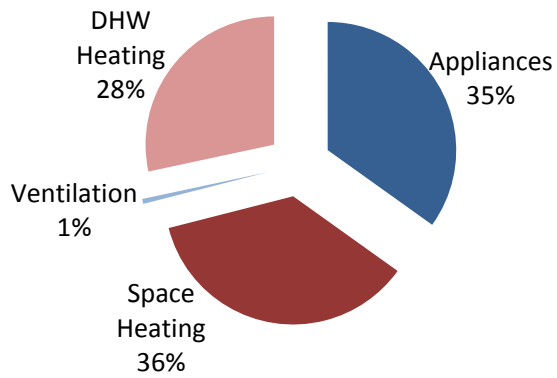
Abbotsford: 170 kWh/m<sup>2</sup>



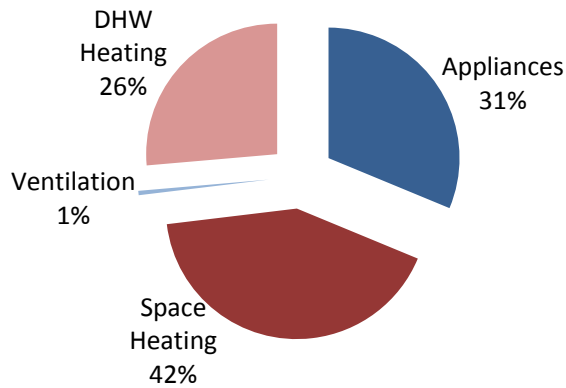
Kamloops: 190 kWh/m<sup>2</sup>



Whistler: 200 kWh/m<sup>2</sup>



Prince George: 230 kWh/m<sup>2</sup>



Fort Nelson: 280 kWh/m<sup>2</sup>

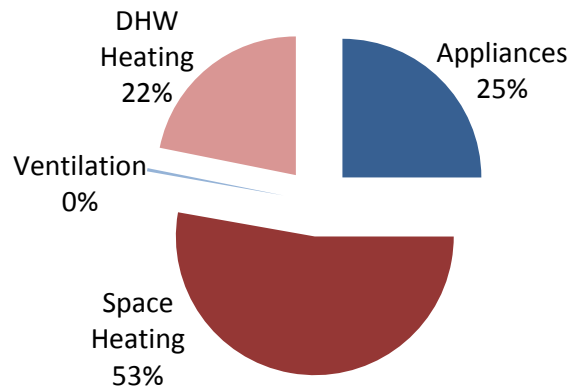


Fig.1.1 Energy consumption of baseline framed houses in five BC climates, Archetype 1.

**EGH Ratings for Log Homes**

The following plot shows the EGH ratings for the baseline archetype house with log walls of varying species (Douglas Fir and Western Red Cedar) and sizes (10", 14", 18" diameter).

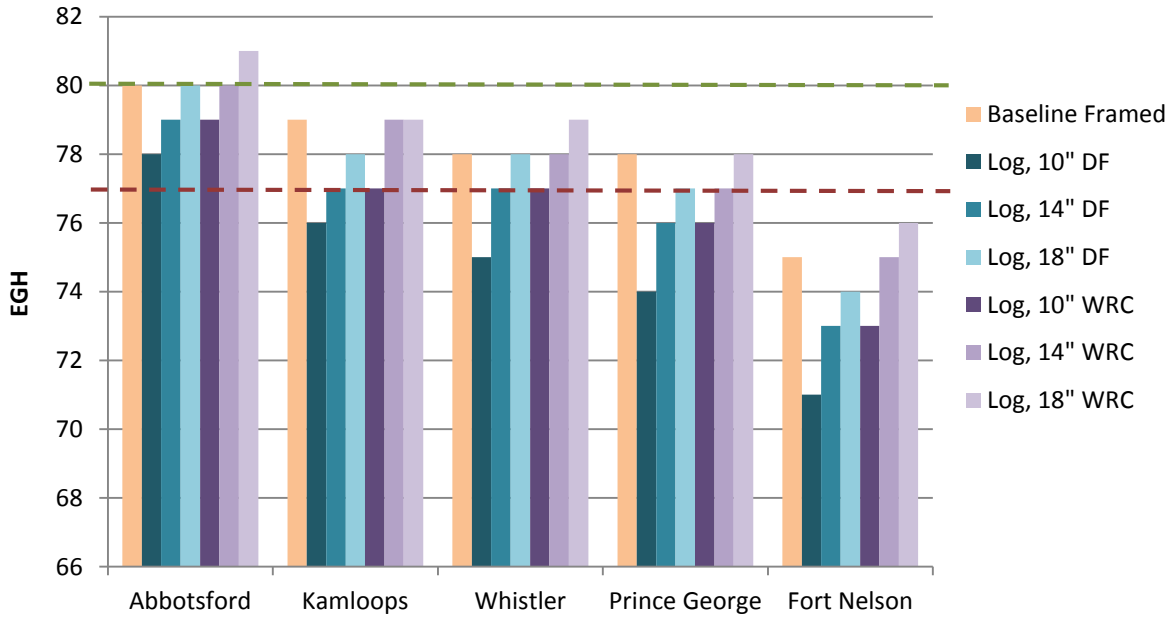


Fig.1.2 Energy consumption of log homes, Archetype 1.

**EGH Ratings for Individual EEMs**

The following plots show the EGH ratings for the individual EEMs simulated with the log wall house with 10" Douglas Fir walls. The plots show the energy simulation results for the baseline framed house, the baseline house with log walls (10" Douglas Fir), and the same house with each EEM that was investigated.

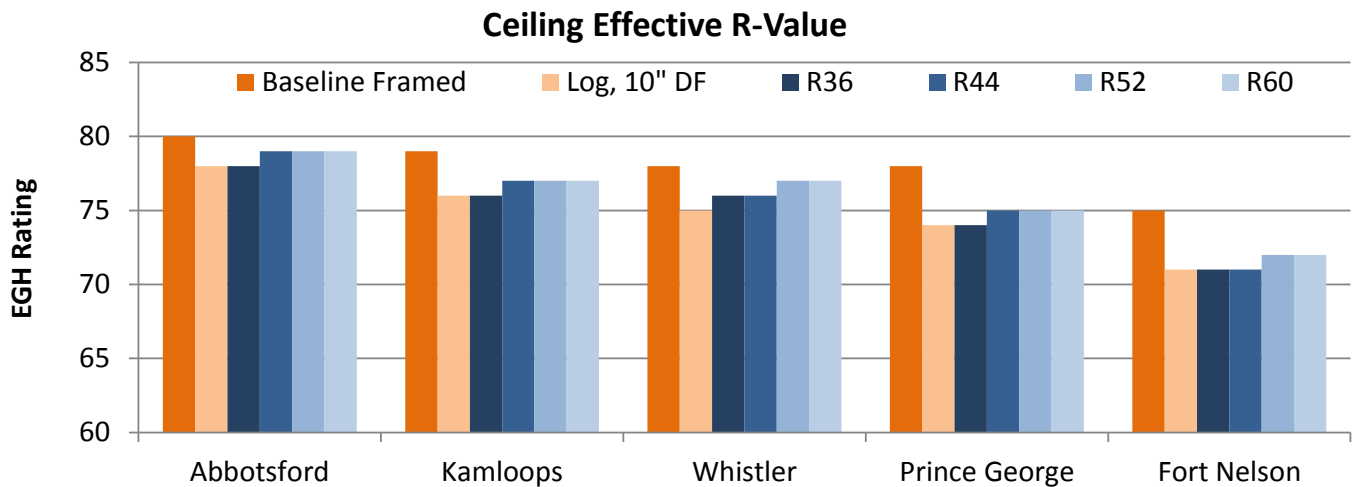


Fig.1.3 Energy consumption of log homes with improved ceiling insulation, Archetype 1.

### Wall Effective R-Value

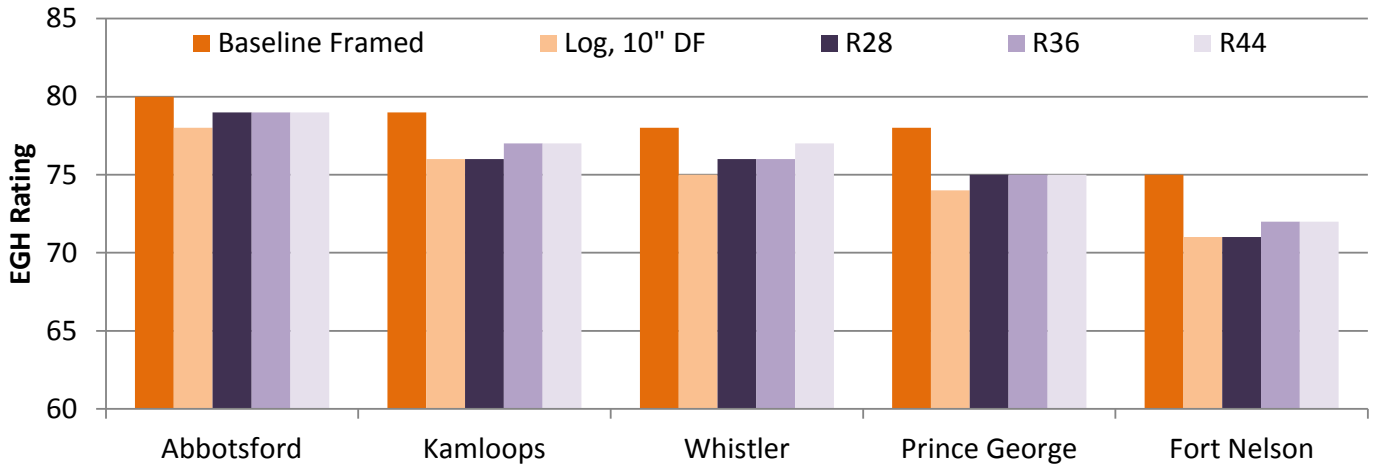


Fig.1.4 Energy consumption of log homes with improved framed wall insulation (framed walls at gables and knee walls), Archetype 1.

### Windows

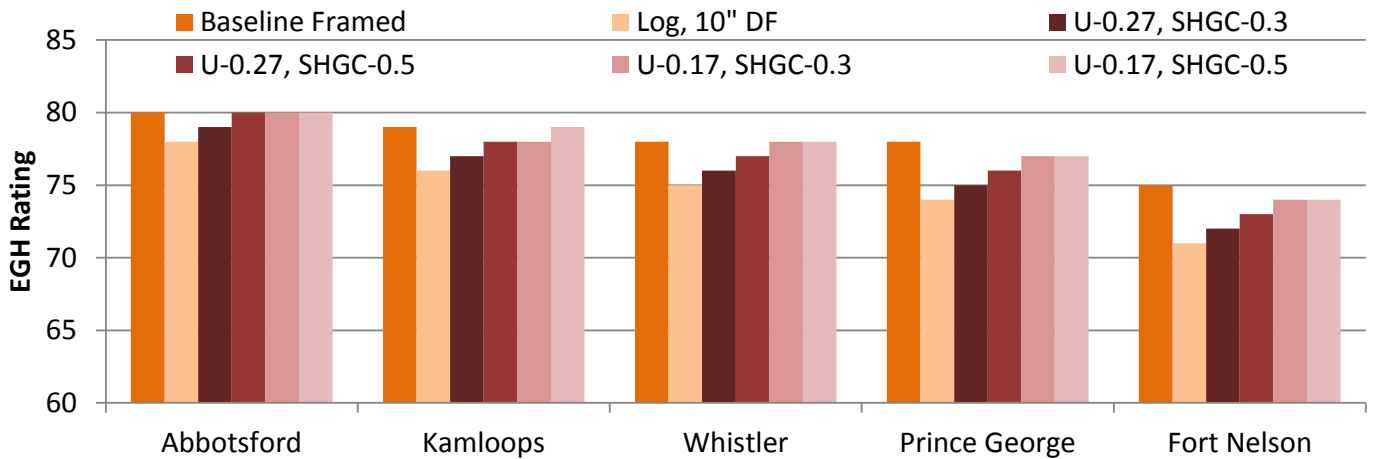


Fig.1.5 Energy consumption of log homes with improved windows, Archetype 1.

### Slab Insulation

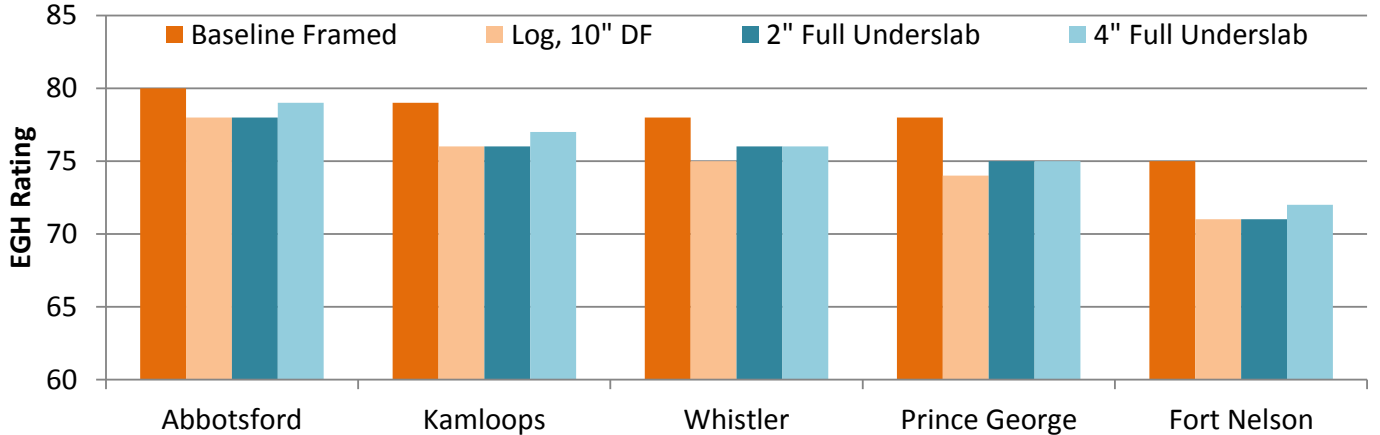


Fig.1.6 Energy consumption of log homes with improved slab insulation, Archetype 1.

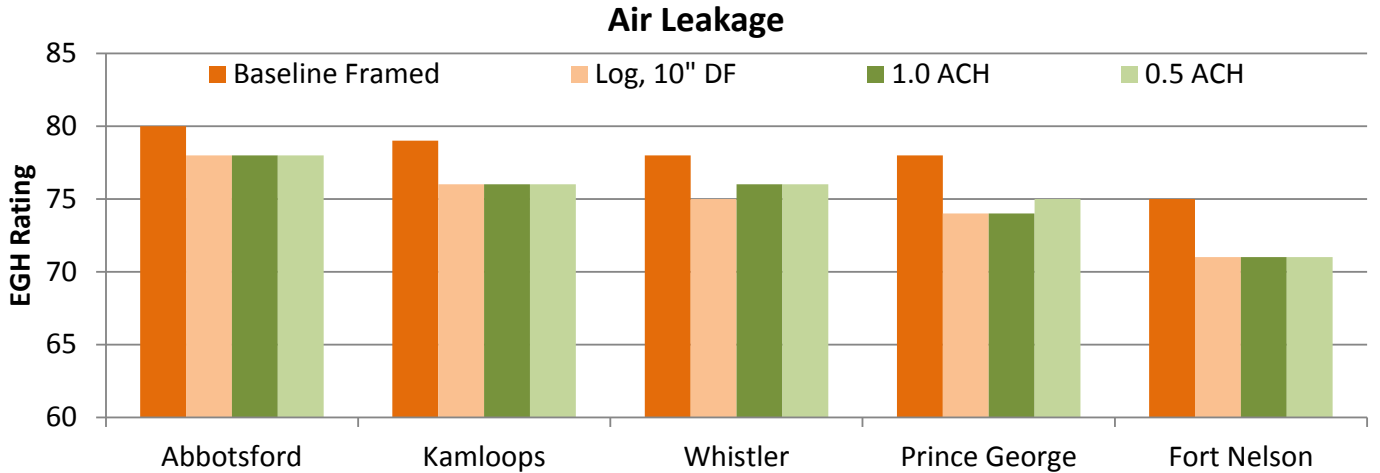


Fig.1.7 Energy consumption of log homes with improved air tightness, Archetype 1.

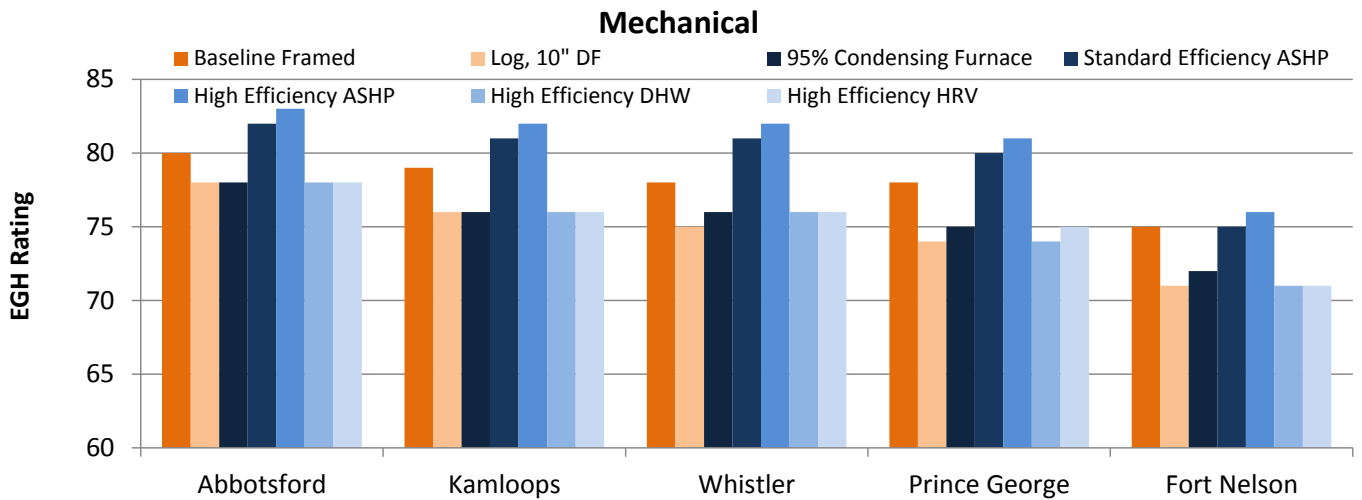


Fig.1.8 Energy consumption of log homes with improved mechanical systems, Archetype 1.<sup>1</sup>

### EGH Ratings for Groups of EEMs

The following plots show the EGH ratings for the groups of EEMs simulated with the log wall house with 10" Douglas Fir walls, 14" Douglas Fir walls, and 14" Western Red Cedar walls. The plots show the energy simulation results for the baseline framed house, the baseline house with log walls, and the same house with each group of EEMs that was investigated.

<sup>1</sup> Note air source heat pump may not be feasible in colder climates.

### Combined Energy Improvements, 10" Douglas Fir

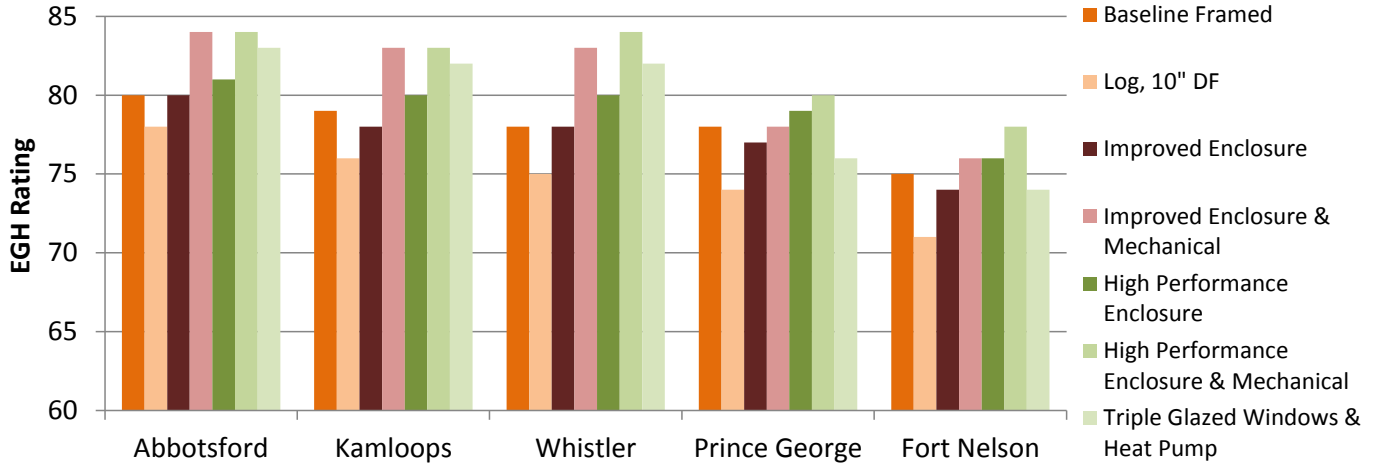


Fig.1.9 Energy consumption of log homes with combinations of Energy Efficiency Measures, 10" Douglas Fir log walls, Archetype 1.<sup>2</sup>

### Combined Energy Improvements, 14" Douglas Fir

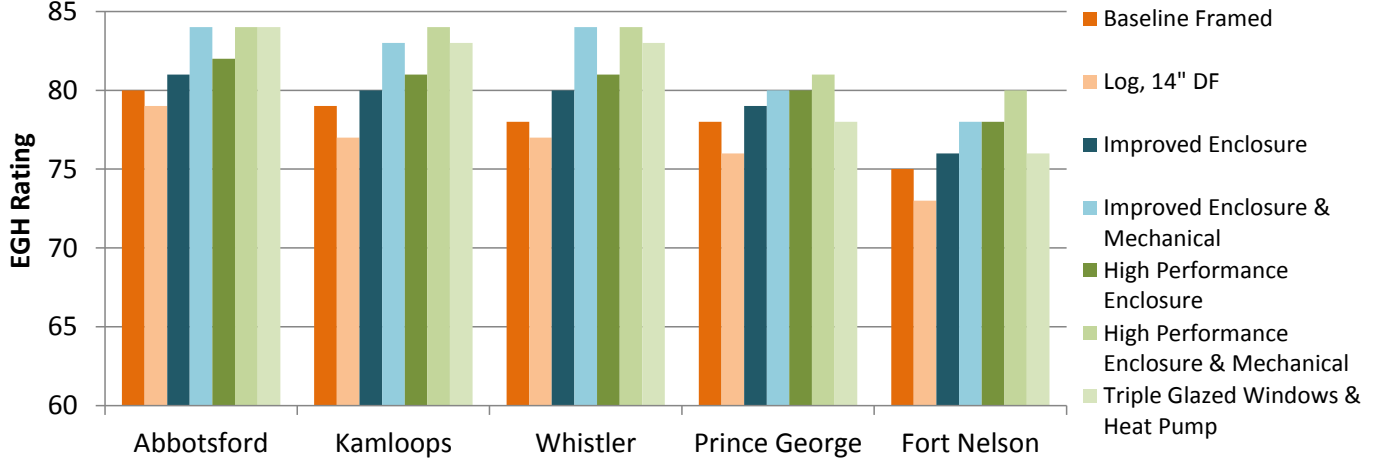


Fig.1.10 Energy consumption of log homes with combinations of Energy Efficiency Measures, 14" Douglas Fir log walls, Archetype 1.<sup>2</sup>

<sup>2</sup> Prince George and Fort Nelson modeled with high efficiency furnace instead of heat pump.

### Combined Energy Improvements, 14" Western Red Cedar

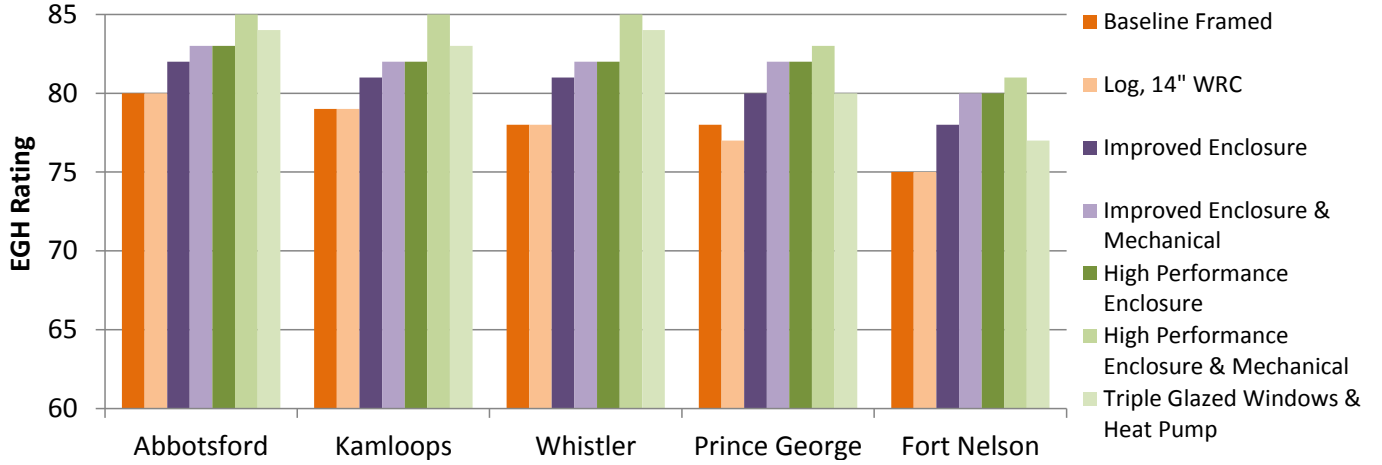


Fig.1.11 Energy consumption of log homes with combinations of Energy Efficiency Measures, 14" Western Red Cedar log walls, Archetype 1.<sup>2</sup>



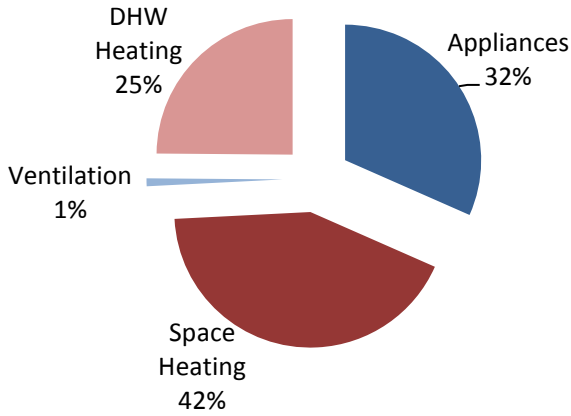
## 1.2. Archetype 2 Results

### Energy Consumption of Baseline Framed House

The following plots show the distribution of energy consumption, and the energy use intensity (kWh/m<sup>2</sup>) of the energy simulation for the baseline framed house.

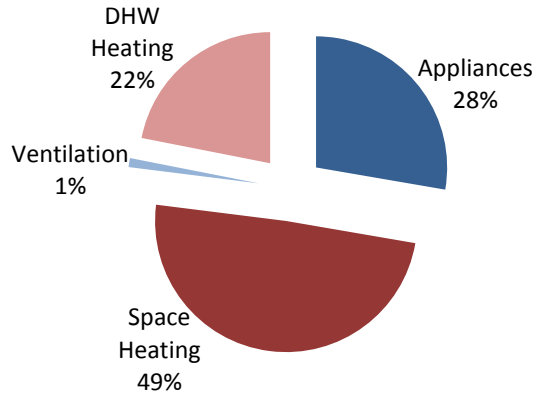
Abbotsford: 116 kWh/m<sup>2</sup>

(174 kWh/m<sup>2</sup> excluding basement floor area)



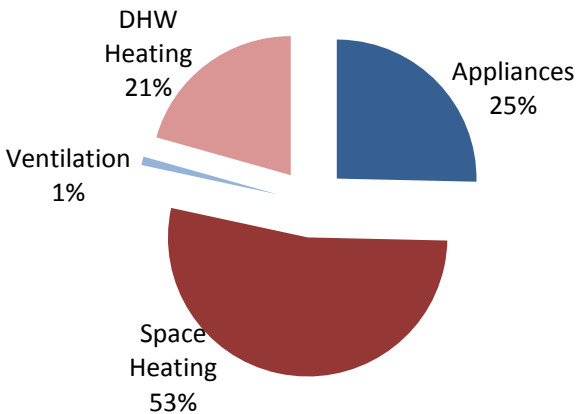
Kamloops: 133 kWh/m<sup>2</sup>

(200 kWh/m<sup>2</sup> excluding basement floor area)



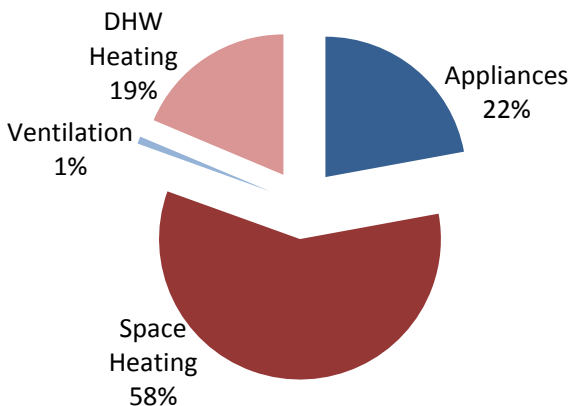
Whistler: 145 kWh/m<sup>2</sup>

(217 kWh/m<sup>2</sup> excluding basement floor area)



Prince George: 166 kWh/m<sup>2</sup>

(249 kWh/m<sup>2</sup> excluding basement floor area)



Fort Nelson: 209 kWh/m<sup>2</sup>

(313 kWh/m<sup>2</sup> excluding basement floor area)

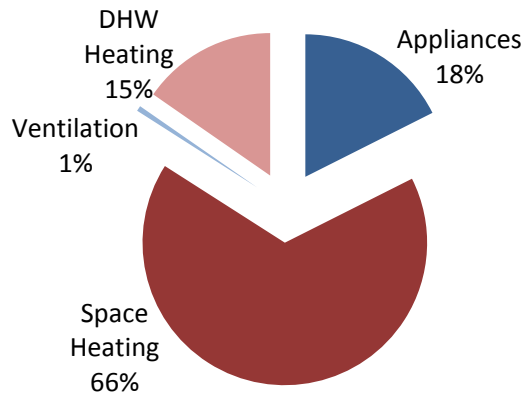


Fig.1.12 Energy consumption of baseline framed houses in five BC climates, Archetype 2.

### EGH Ratings for Log Homes

The following plot shows the EGH ratings for the baseline archetype #2 house with log walls of varying species (Douglas Fir and Western Red Cedar) and sizes (10", 14", 18" diameter).

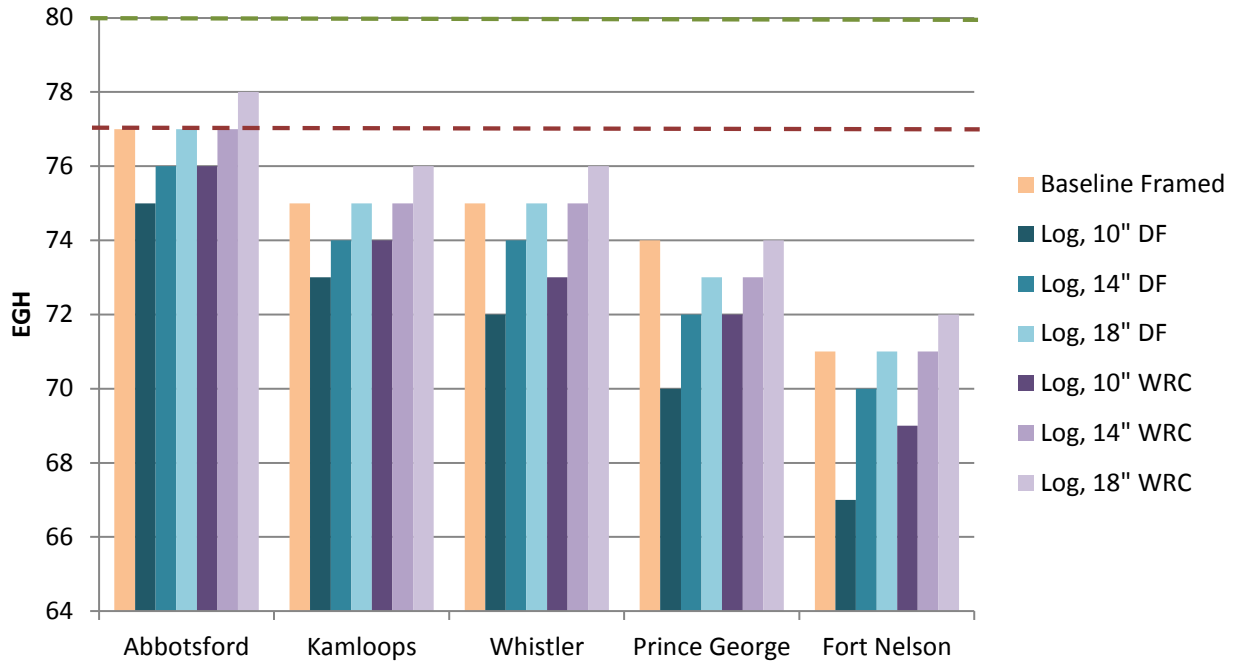


Fig.1.13 Energy consumption of log homes, Archetype 2.

### EGH Ratings for Individual EEMs

The following plots show the EGH ratings for the individual EEMs simulated with the log wall house with 10" Douglas Fir walls. The plots show the energy simulation results for the baseline framed house, the baseline house with log walls (10" Douglas Fir), and the same house with each EEM that was investigated.

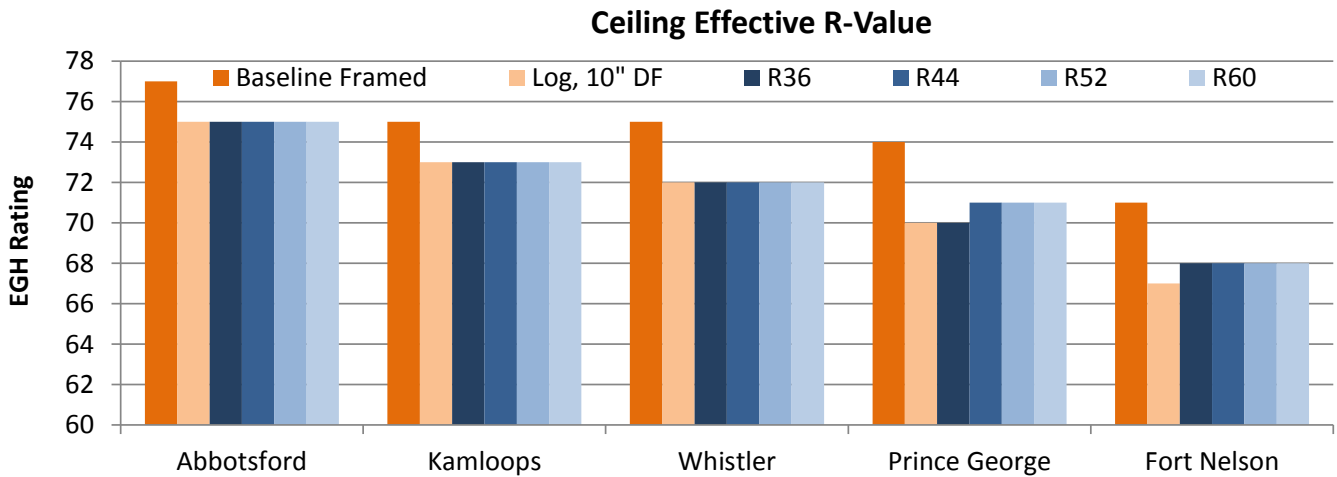


Fig.1.14 Energy consumption of log homes with improved ceiling insulation, Archetype 2.

### Wall Effective R-Value

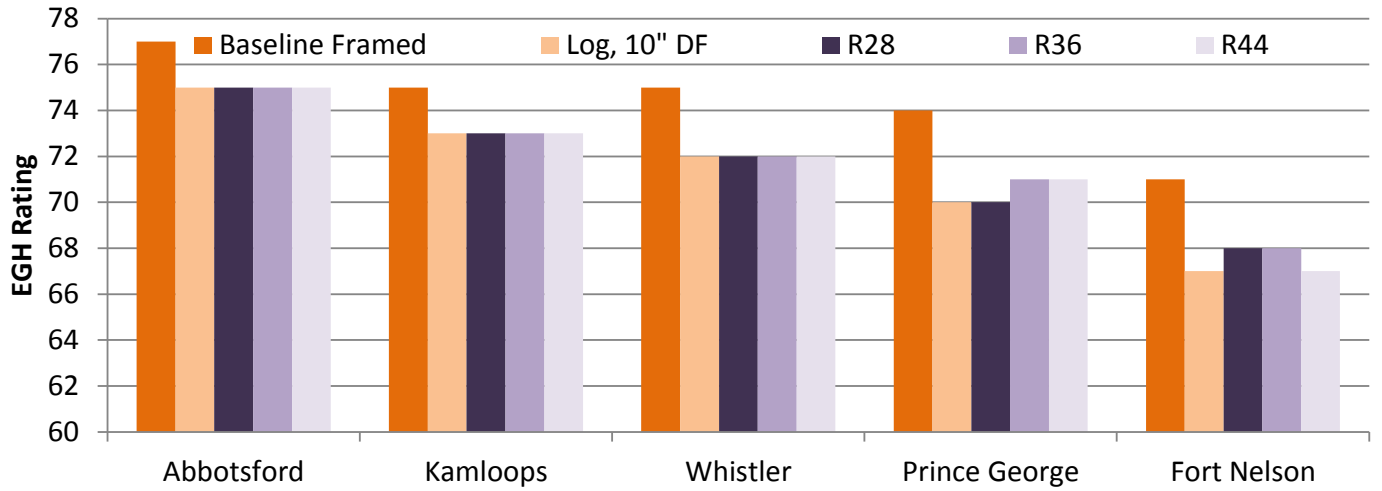


Fig.1.15 Energy consumption of log homes with improved framed wall insulation (framed walls at gables and knee walls), Archetype 2.

### Windows

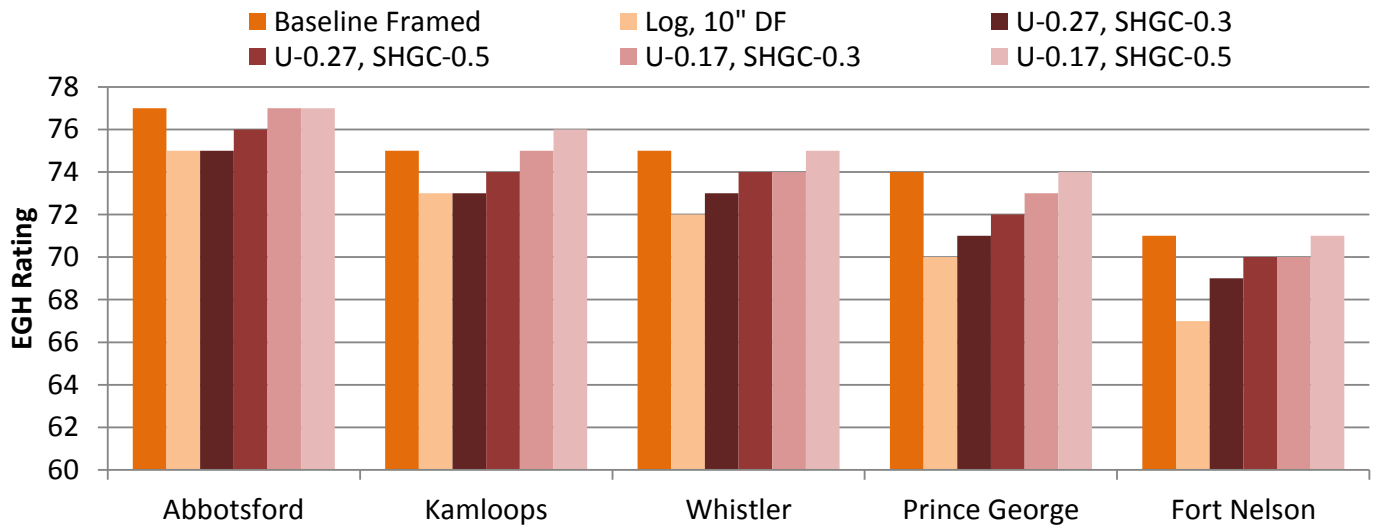


Fig.1.16 Energy consumption of log homes with improved windows, Archetype 2.

### Below Grade Insulation

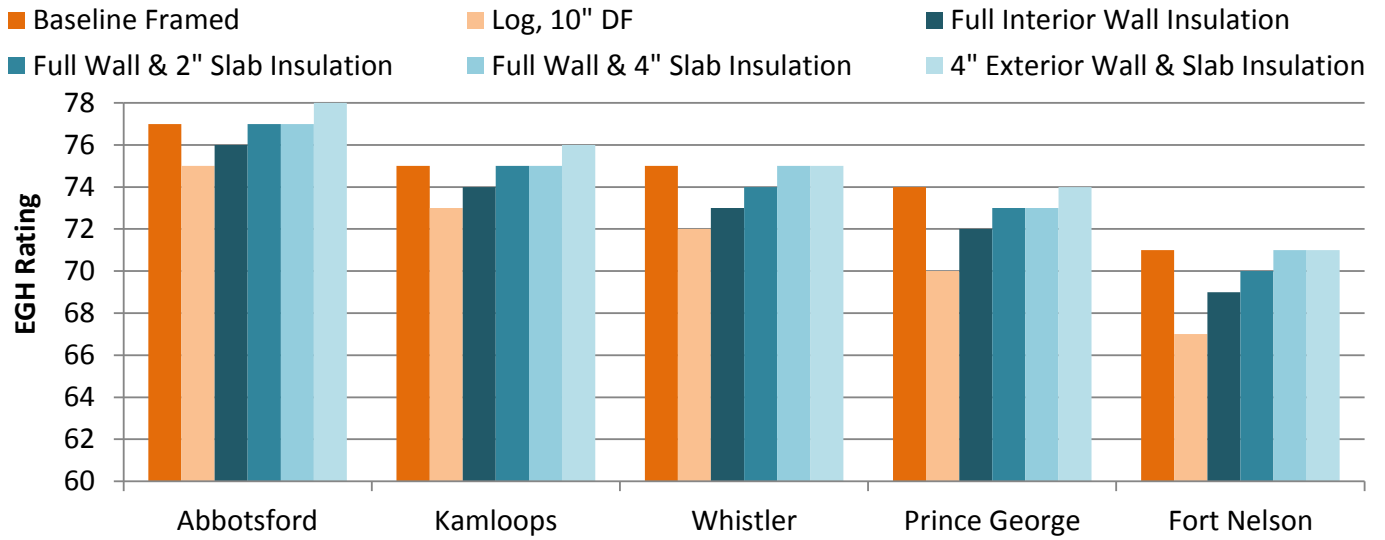


Fig.1.17 Energy consumption of log homes with improved slab insulation, Archetype 2.

### Air Leakage

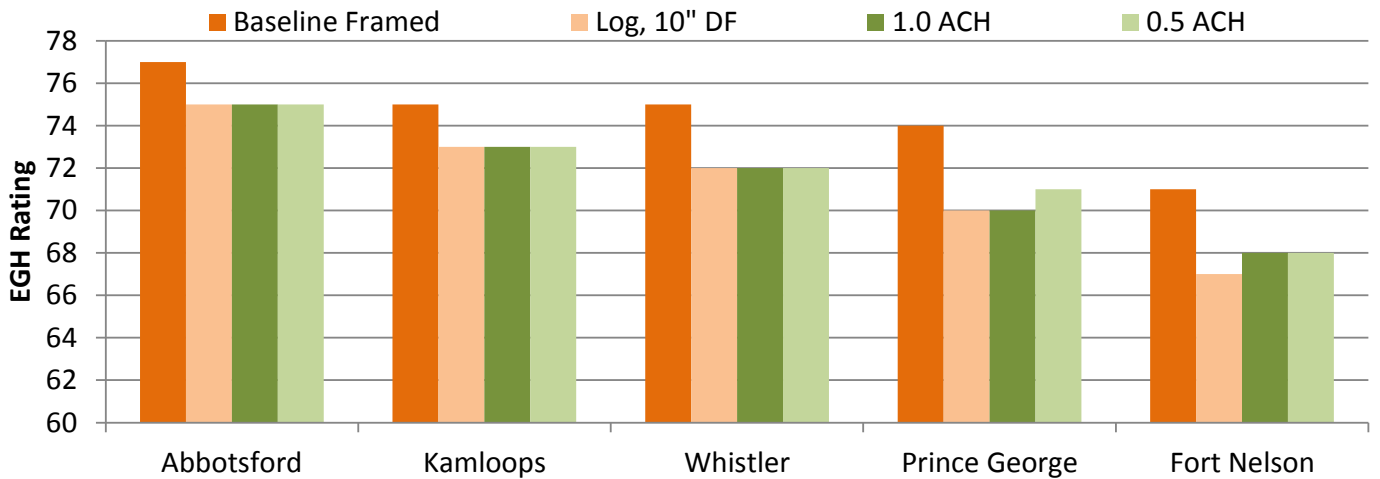


Fig.1.18 Energy consumption of log homes with improved air tightness, Archetype 2.

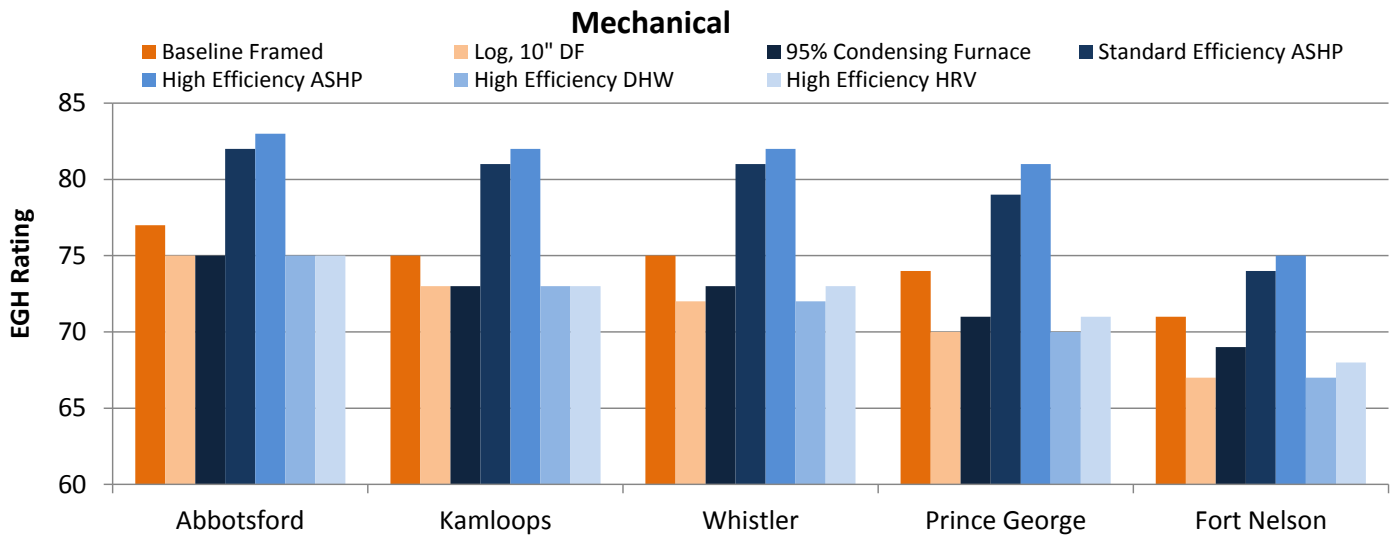


Fig.1.19 Energy consumption of log homes with improved mechanical systems, Archetype 2.<sup>3</sup>

### EGH Ratings for Groups of EEMs

The following plots show the EGH ratings for the groups of EEMs simulated with the log wall house with 10" Douglas Fir walls, 14" Douglas Fir walls, and 14" Western Red Cedar walls. The plots show the energy simulation results for the baseline framed house, the baseline house with log walls, and the same house with each group of EEMs that was investigated.

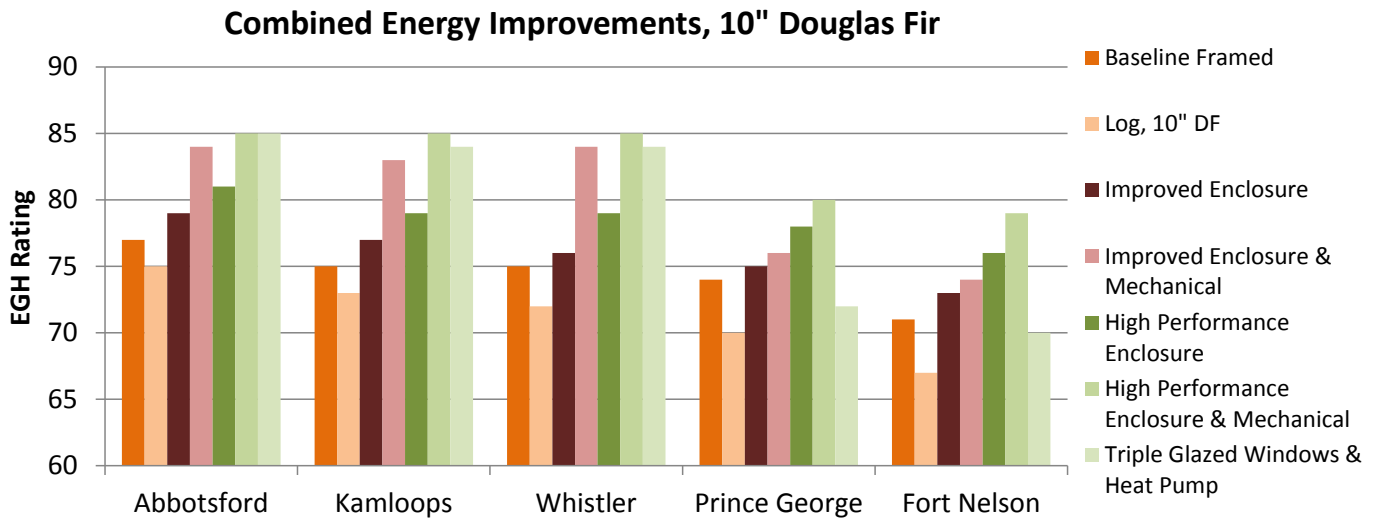


Fig.1.20 Energy consumption of log homes with combinations of Energy Efficiency Measures, 10" Douglas Fir log walls, Archetype 2.<sup>4</sup>

<sup>3</sup> Note air source heat pump may not be feasible in colder climates.

<sup>4</sup> Prince George and Fort Nelson modeled with high efficiency furnace instead of heat pump.

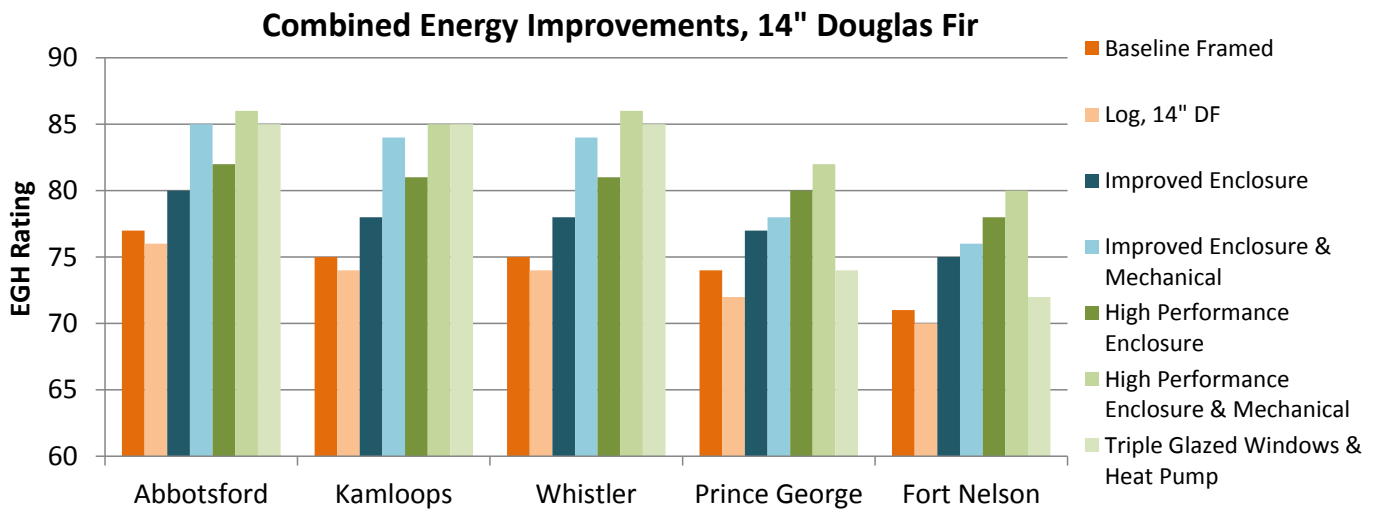


Fig.1.21 Energy consumption of log homes with combinations of Energy Efficiency Measures, 14" Douglas Fir log walls, Archetype 2.<sup>4</sup>

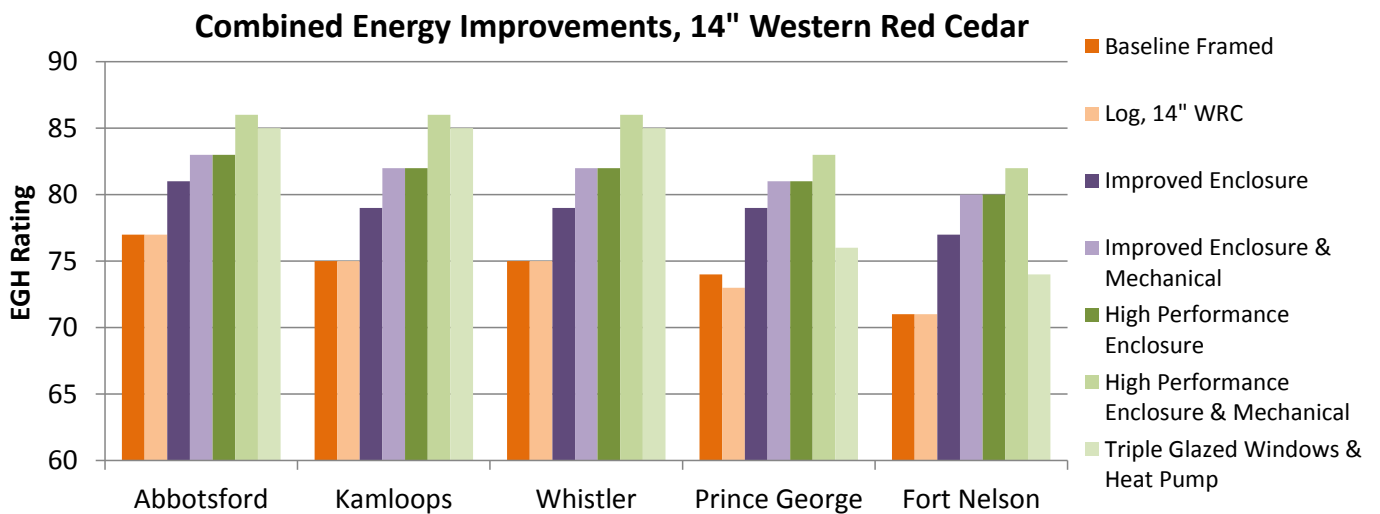


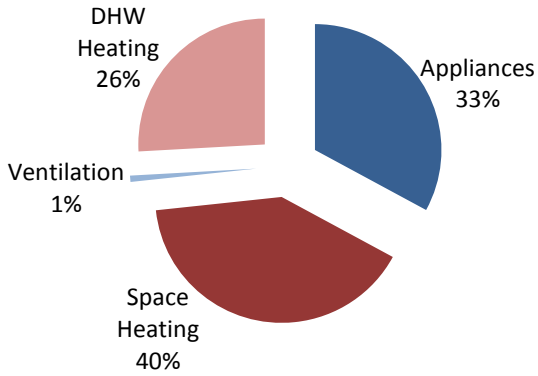
Fig.1.22 Energy consumption of log homes with combinations of Energy Efficiency Measures, 14" Western Red Cedar log walls, Archetype 2.<sup>4</sup>

### 1.3. Archetype 3 Results

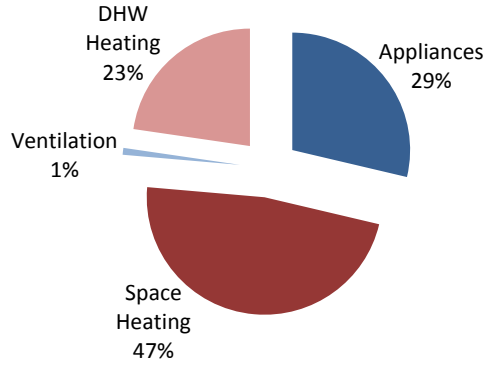
#### Energy Consumption of Baseline Framed House

The following plots show the distribution of energy consumption, and the energy use intensity (kWh/m<sup>2</sup>) of the energy simulation for the baseline framed house.

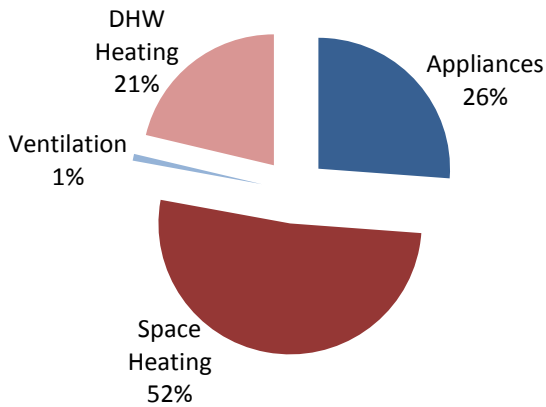
Abbotsford: 107 kWh/m<sup>2</sup>



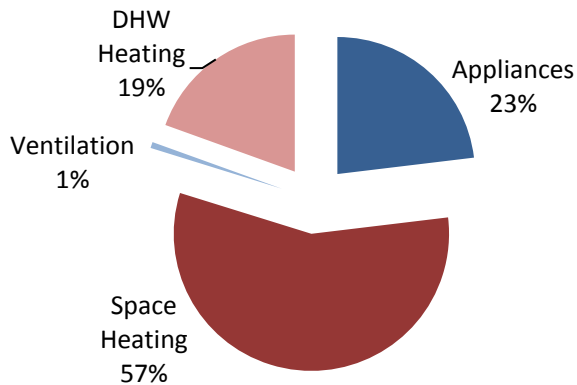
Kamloops: 123 kWh/m<sup>2</sup>



Whistler: 135 kWh/m<sup>2</sup>



Prince George: 153 kWh/m<sup>2</sup>



Fort Nelson: 195 kWh/m<sup>2</sup>

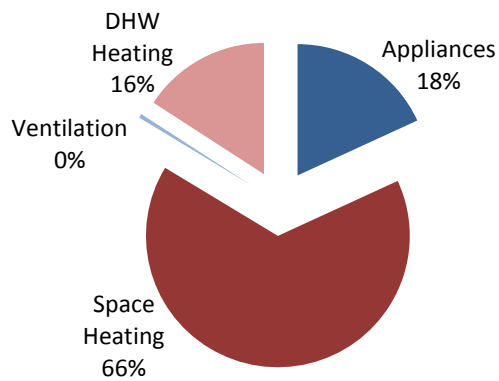


Fig.1.23 Energy consumption of baseline framed houses in five BC climates, Archetype 3.

### EGH Ratings for Log Homes

The following plot shows the EGH ratings for the baseline archetype #3 house with log walls of varying species (Douglas Fir and Western Red Cedar) and sizes (10", 14", 18" diameter).

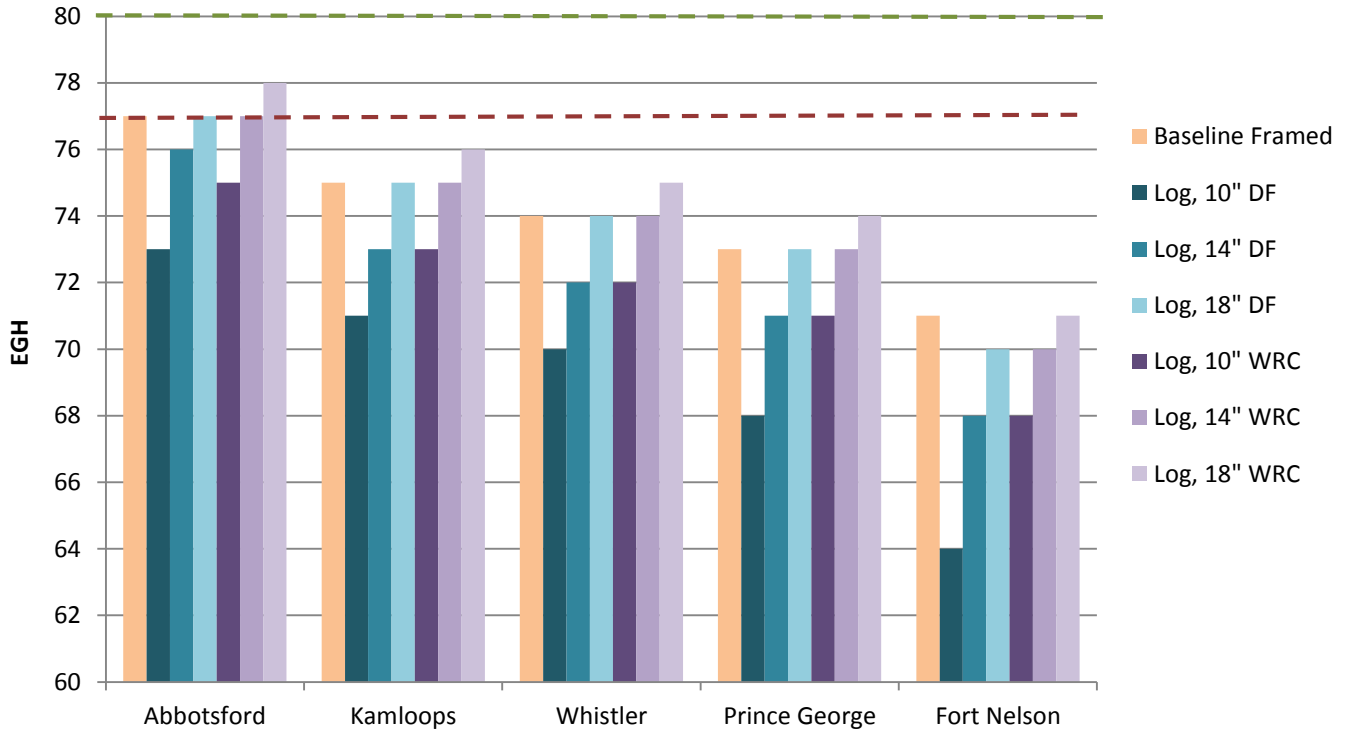


Fig.1.24 Energy consumption of log homes, Archetype 3.

### EGH Ratings for Individual EEMs

The following plots show the EGH ratings for the individual EEMs simulated with the log wall house with 10" Douglas Fir walls. The plots show the energy simulation results for the baseline framed house, the baseline house with log walls (10" Douglas Fir), and the same house with each EEM that was investigated. Not all EEMs were simulated for Archetype 3, only the high performance windows and heat pump measures were investigated with this archetype.

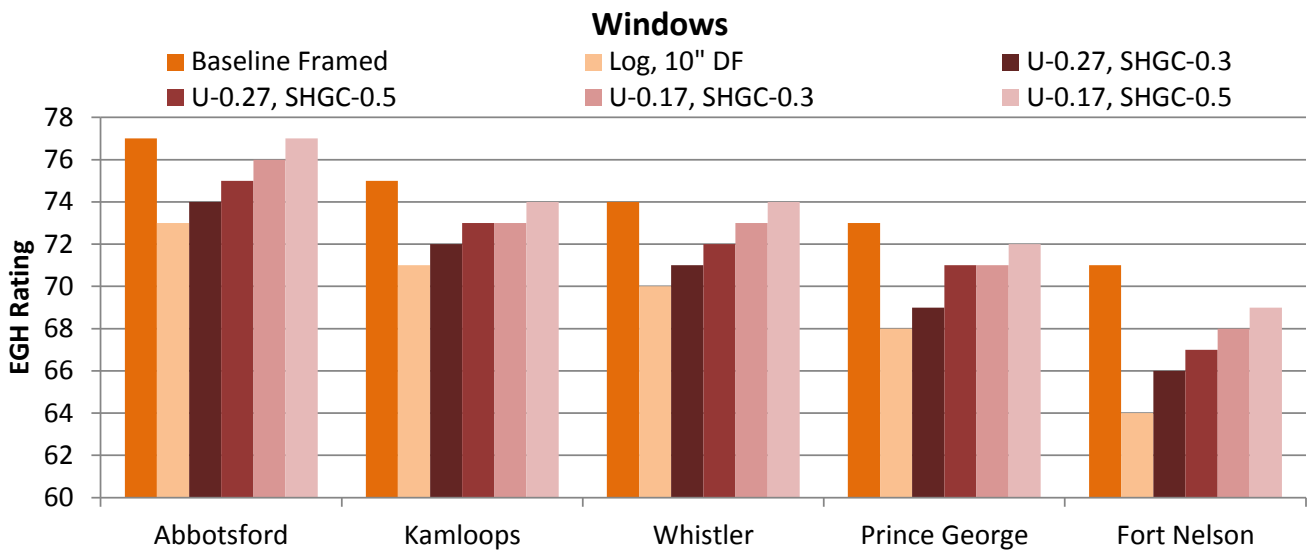


Fig.1.25 Energy consumption of log homes with improved windows, Archetype 3.



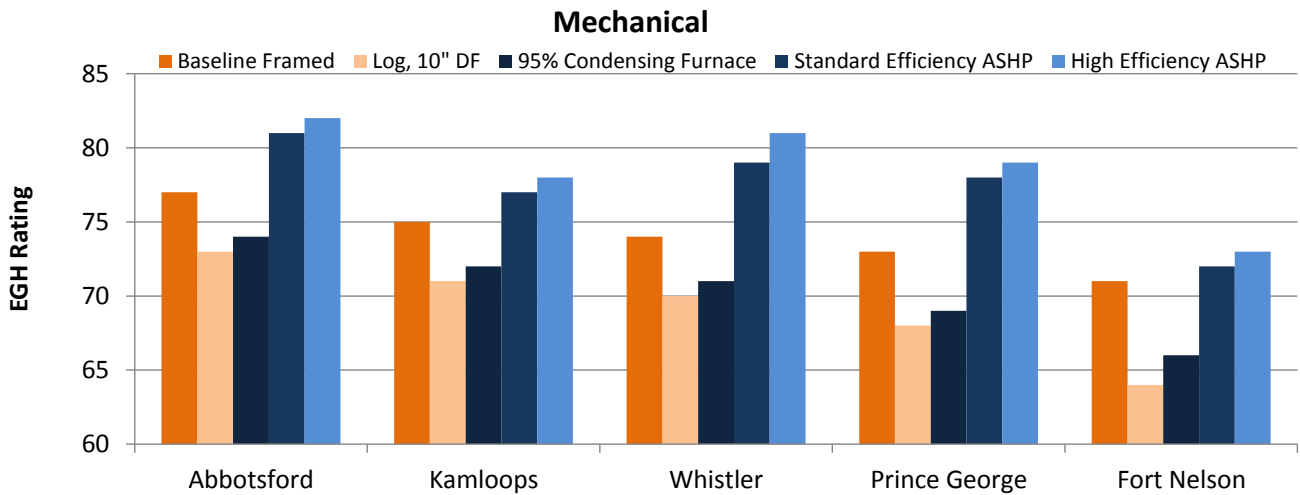


Fig.1.26 Energy consumption of log homes with improved mechanical systems, Archetype 3.<sup>5</sup>

### EGH Ratings for Groups of EEMs

The following plots show the EGH ratings for the groups of EEMs simulated with the log wall house with 10" Douglas Fir walls, 14" Douglas Fir walls, and 14" Western Red Cedar walls. The plots show the energy simulation results for the baseline framed house, the baseline house with log walls, and the same house with each group of EEMs that was investigated.

### Combined Energy Improvements, 10" Douglas Fir

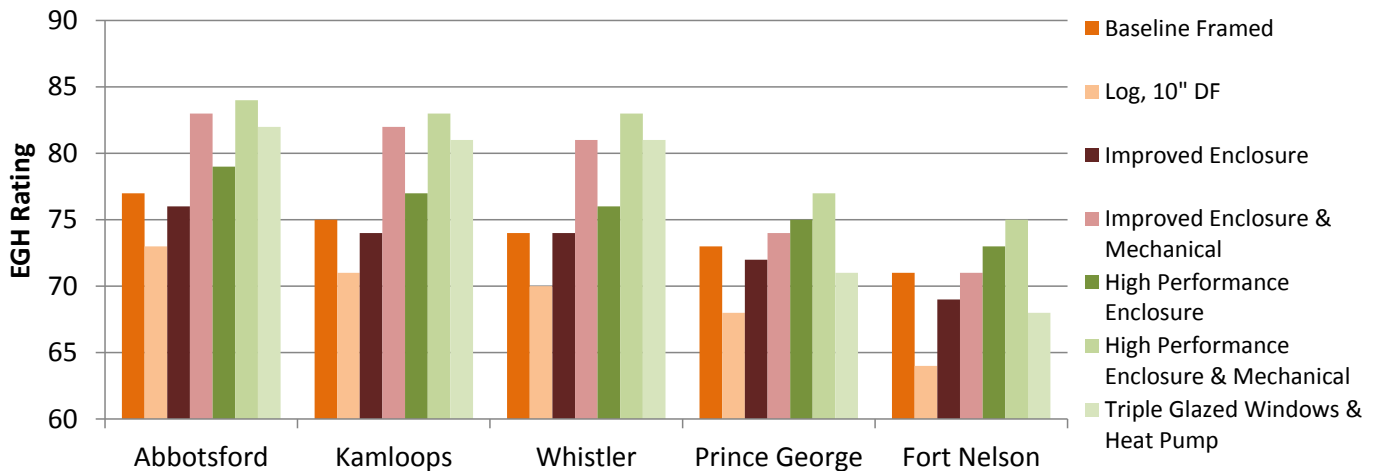


Fig.1.27 Energy consumption of log homes with combinations of Energy Efficiency Measures, 10" Douglas Fir log walls, Archetype 3.<sup>6</sup>

<sup>5</sup> Note air source heat pump may not be feasible in colder climates.

<sup>6</sup> Prince George and Fort Nelson modeled with high efficiency furnace instead of heat pump.

### Combined Energy Improvements, 14" Douglas Fir

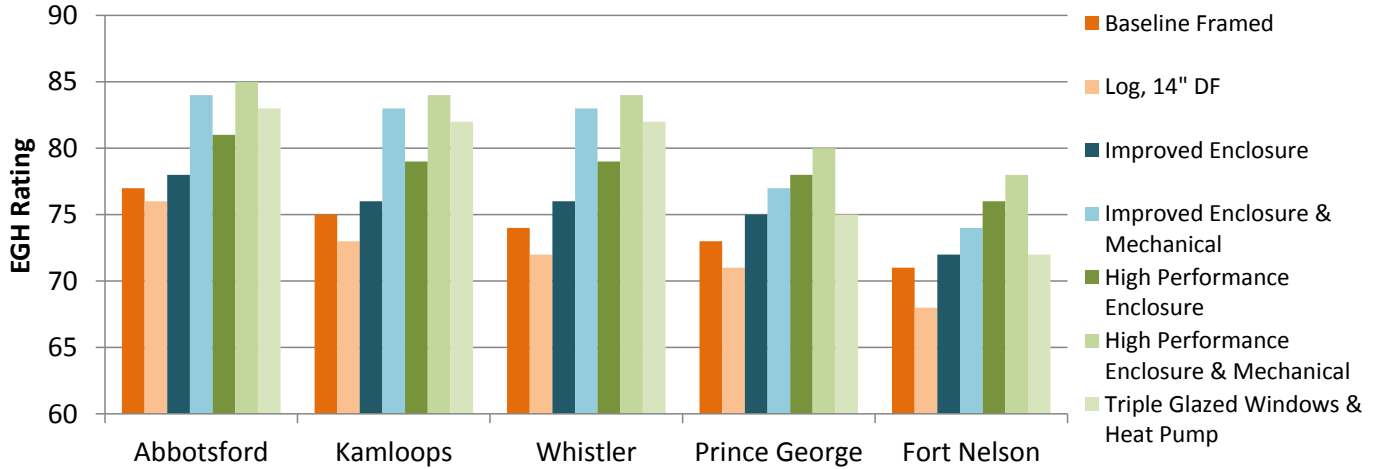


Fig.1.28 Energy consumption of log homes with combinations of Energy Efficiency Measures, 14" Douglas Fir log walls, Archetype 3.<sup>6</sup>

### Combined Energy Improvements, 14" Western Red Cedar

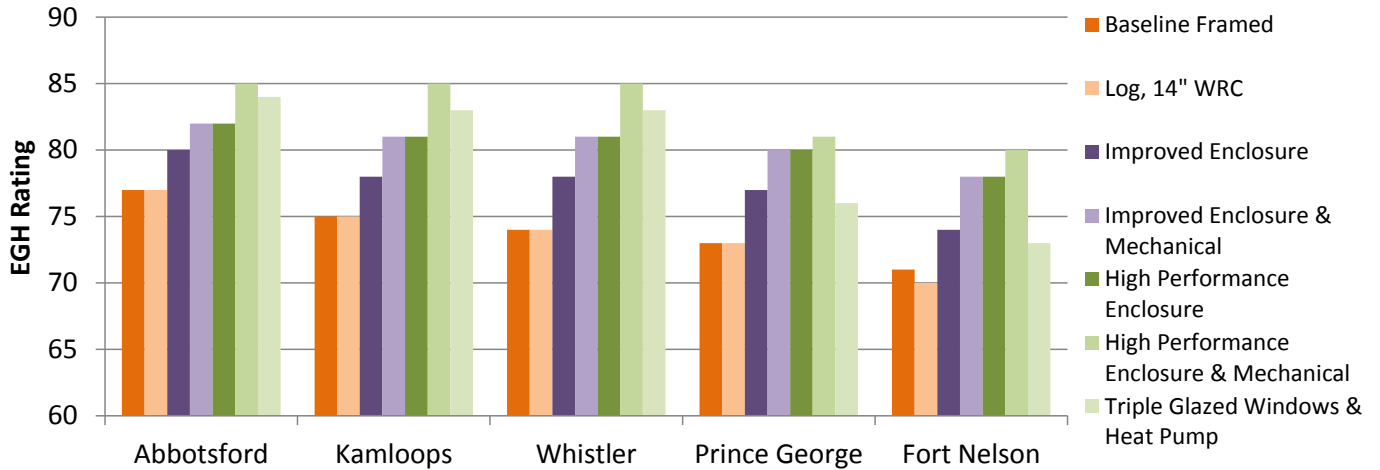


Fig.1.29 Energy consumption of log homes with combinations of Energy Efficiency Measures, 14" Western Red Cedar log walls, Archetype 3.<sup>6</sup>