

This proposed change comprehensively develops the prescriptive trade-off compliance path to provide Code users with an acceptable solution that uses different energy conservation measures (ECMs) to improve the total energy performance.

Methodology

The impact analysis aimed to determine all permutations of ECM combinations for given building archetypes.

Constraints on the analysis:

- No interpolation was considered
- No oil-fired furnaces were included
- Only ECMs for instantaneous gas and EF = 2.35 heat pumps for hot service water were considered
- Only cold climate air-source heat pumps (ccASHPs) covering 60% of load were considered. However, air-source heat pumps and equation tables were not considered.

Sources

- Envelope Assembly ECMs were costed using RSMeans (2023)
 - Windows and airtightness were costed using estimates from the Housing Technology Assessment Program/Local Energy Efficiency Partnerships (HTAP/LEEP)
 - Adjusted for inflation (assumed to be 41%)
- Service water heating systems estimated from HTAP/LEEP
 - Adjusted for inflation (assumed to be 41%)
- Drain-water heat-recovery costing data from PCF 1835
 - Installation costs estimated from HTAP/LEEP (adjusted for inflation)
- Heat-recovery ventilator/energy-recovery ventilator (HRV/ERV) costing data from PCF 1838

Building Archetypes

Table 1 shows the four building archetypes used in the simulation for estimating costs for different energy performance tiers.

Table 1 . Building Archetypes Considered in the Impact Analysis

Archetype	ERS-5213	ERS-7972	ERS-4943	ERS-1605
Type	Detached	Row House, End Unit	Detached	Double/Semi-detached
Volume, m ³	664	451	112	193
Storeys	2	2	1.5	1
Floor area, ft. ²	2,400	2,370	470	580
Foundation	Full basement	Full basement	Slab-on-grade	Slab-on-grade
Net above-ground wall area, m ²	171.71	128.53	78.29	78.51
Gross floor header area, m ²	22.36	0	6.64	0
Net attic area, m ²	82.68	83.98	0	78.97

Net flat roof area, m ²	7.71	0.84	64.80	0
Exposed floor area, m ²	10.87	0.84	11.52	0
Window area, m ²	29.01	9.23	6.97	6.09
Skylight area, m ²	0	0.42	0.74	0
Door area, m ²	9.91	6.94	3.72	5.57
Net below-ground wall area, m ²	87.96	25.24	0	0
Slab-on-grade area, m ²	0	0	18.58	78.97
Basement slab area, m ²	74.60	52.28	0	0

Costing of Different ECMs

Exterior Wall Costing

Table 2 shows the incremental cost of exterior walls constructed with brick or vinyl. The Code minimum or base RSI is 2.78.

Table 2. Incremental Cost of Exterior Walls: Brick versus Vinyl

RSI	Incremental Cost – Brick [USD/m ²]	Incremental Cost – Vinyl [USD/m ²]
2.78	0.00	0.00
3.08	3.02	3.93
3.85	10.77	14.03
4.84	20.73	27.01
5.01	22.44	29.24
5.45	26.87	35.01

We estimated an average cost per ft.² for a given effective RSI using a regression developed from 231 wall assemblies taken from the Canadian Wood Council Effective R Calculator and costed using 2023 RSMMeans data. There are no single-wall specifications for the RSI values listed. Appendix B of the Model National Energy Code of Canada for Buildings 1997 (available online [here](#)) is one resource that provides wall assembly details for different effective RSI values.

Costing of Space Heating and Cooling Systems

Gas-fired Furnace

- Unit cost function of capacity and AFUE
 - Cost per capacity estimated from RSMMeans (2023)
- Assume additional \$500/% increase of AFUE above 95%^[1]
- Reference system capacity taken from reference model results
 - Rounded up to nearest 0.5 ton (6,000 Btu/h)

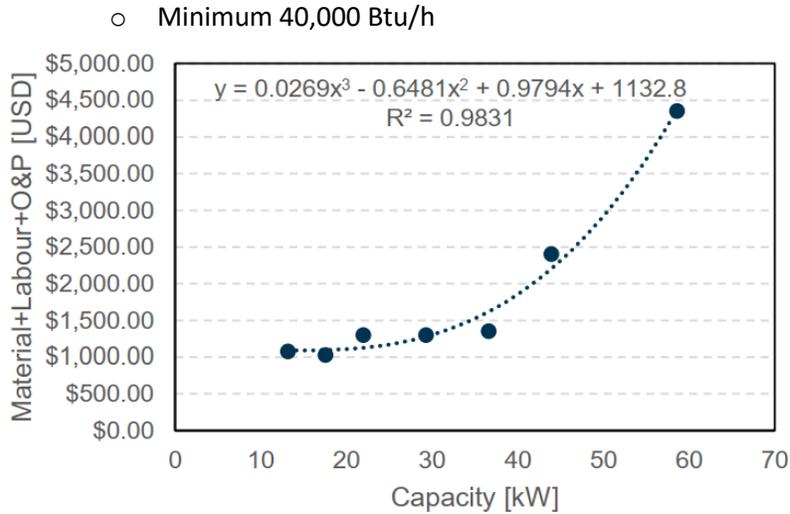


Figure 1. Costs related to gas-fired furnaces by capacity^[1]

- Upgrade system capacity of house estimated from energy conservation points for building envelope measures and reference system capacity
- Regression used to estimate heat loss reduction of building envelope
 - Heat loss reduction used as proxy for peak heating reduction
- Rounded up to nearest 0.5 ton (6,000 Btu/h)
- Minimum 40,000 Btu/h

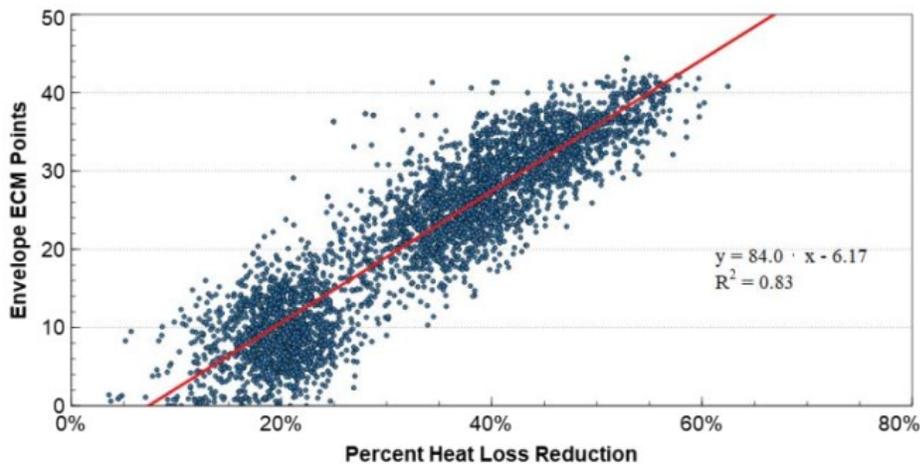


Figure 2. Energy conservation points for building envelope measures by percentage heat loss reduction

ASHP Costing

- Base system electric furnace with conventional A/C
 - Electric furnace cost function of capacity, estimate from RSMeans (2023)
 - Capacity rounded up to nearest 0.5 ton (6,000 BTU), min. 18,000 Btu/h
 - 3 ton cooling system assumed, RSMeans (2023) costs

- Upgrade system ducted ASHP with electric backup
 - Cost per capacity estimated from^[2]
 - Estimated additional \$1,500 per HSPF2 V above 6.7^{[3][4]}
 - Heating capacity of upgraded house estimated from regression

References

- [1] <https://www.furnaceprices.ca/furnaces/furnace-prices-canada/>
- [2] <https://1clickheat.com/product/tosot-apex-20-seer-central-heat-pump-and-air-handler/>
- [3] <https://1clickheat.com/product/moovair-multi-zone-ductless-heat-pump-25-rated/>
- [4] <https://1clickheat.com/product/moovair-multi-zone-ductless-heat-pump/>