

Introduction to the Passive House Standard

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Some low-energy homes

1976 Lo-Cal House, Illinois

- R-60 ceilings
- R-30 walls
- Solar orientation
(not overdone)
- Triple-glazed

Some low-energy homes

1977 Saskatchewan Conservation House

- R-60 ceilings
- R-44 walls
- 0.80 ACH₅₀
 - ACH₅₀:
57 km/h wind, occurs
1 day every month
- Air-to-air
Heat exchanger
(HRV)

Some low-energy homes

1991 Darmstadt Passive House

- R-52 ceiling
- R-41 walls
- R-43 floor
- 0.20 ACH₅₀

Building Code

2006 Building Code not yet at 1970's capability

- R-40 Ceiling
- R-19 Walls
- R-8 Floor
- No airtightness requirement, approximately 4.0 to 5.0 ACH₅₀ (ten times worse)
- Prescriptive, not performance-based

Meanwhile...

- Over 20,000 Passive House buildings in Europe, and growing
- European Union have adopted resolutions to make Passive House mandatory in 2015 (2013 in UK)
- We have trouble making 1980's quality mandatory (EnerGuide 80, lower than R-2000)

Not just about houses

- Translation of PassivHaus is **passive-energy building**
 - Single-family, multi-storey residential and hotels
 - Office and administrative buildings
 - Schools & educational facilities

Three Passive House Requirements

1. Airtight: Less than **0.60 ACH₅₀**
 2. Annual heating: Less than **15 kWh/m²**
Retrofit: Less than **25 kWh/m²**
 3. Annual total energy: Less than **120 kWh/m²**
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- As calculated using PHPP software
 - Area is *usable indoor* floor area (subtract internal walls)
 - Energy adjusted to include generation type

Implications

If peak coldest day heating demand is 10 W/m^2 , can deliver ALL heat through fresh air only without recirculation, no “scorching” the dust, 300 W per person. **Eliminates furnace or boiler.**

Reality: In northern climates, coldest day is more severe, so small central heater needed

One compact heat pump for heating, cooling, hot water, saves space, very efficient

Implications

- 80-90% heating/cooling savings over current building code
- **Affordable**
 - 10-15% building cost increase, less with land cost and experience
- Passive survivability
- Use of low-temperature heating sources (renewable energy)
- Path to net-zero

Implications

- Encourages more compact homes
- Encourages multi-unit dwellings
- Surface temperatures increased, especially windows, from 15 °C to 18 °C when -14 °C outside.
- No need to place heaters or registers under windows. Let heat gently spread.
- No need for humidification

Component: Windows

- Triple-glazed
- Low emissivity coatings
- Argon-fill
- **Thermal bridge free design**
- R-7 and above (2x better than double low-e argon vinyl)
- Net annual benefit – even for north-facing windows

Component: Ventilation

- Fresh outdoor air supply balanced with exhaust
- Dedicated supply to each room
- Exhaust from contaminated areas
- Heat recovery, pre-heats incoming air with exhaust at minimum 75% effectiveness

Retrofits – External Insulation

- Window moved in plane of new insulation layer

Retrofits – adding ventilation

- Minimally invasive addition of ventilation ducts
- Apartment remains occupied
- Debris removed by vacuum cleaner

Passive Buildings Canada

- Federally Incorporated **Non-Profit**
- **Grassroots**—member-based volunteer organization
- **Democratic**—members elect board of directors, must follow bylaws
- **Modeled** after Austria Passive House Interest Group, CaGBC, other industry groups

Objective

promote and support environmentally neutral
building designs and construction
by **encouraging the design, construction,**
renovation and verification of buildings
to the **Passive House standard in Canada**

What we offer

- First point of contact for Passive House information
- Communications network for members, access to wealth of knowledge among membership base
- **Members commit to help each other**
- Host educational events

Who is a member?

- Builders, trades, manufacturers, architects, engineers, building scientists, project managers, consultants, government representatives, non-governmental organizations, academic institutions
- **Share a common goal** of making all buildings achieve the Passive House standard.

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