



BLDG Studio

Radiance Cohousing

Passive House in Saskatoon?

Presenter: Michael Nemeth

Member of Radiance Cohousing (Future Resident)
& Passive House Consultant on Project

2014 10 01 – EMTF



Wolf Willow Cohousing – Shannon Dyck

Cohousing

- Wolf Willow Cohousing has been a huge inspiration
- Privacy of individual homes, but with access to small village outside your door (yard, common house...)
- Consensus decision making brings people together



Google

Location

Pleased to join the thriving, walkable community of Riversdale.



A collaborative, green housing initiative.

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- Permaculture design
 - Urban food production, gardening
 - Water efficiency and rainwater management
 - Environmentally regenerative practices
- Build in a walkable, bike-able neighbourhood
- Some photovoltaics
- Electric Vehicle ready
- Affordability – modest size
 - + aiming for lower monthly cost of ownership due to reduced utilities

Passive House?

We aim to meet the Passive House standard.

- No reliance on gas and reduce overall reliance on fossil fuels and inevitable rising costs.
- Prudent action against climate change (Factor 9)
- 90% heating energy savings
- Cost-effective net-zero ready?
- A nod to those who have come before us.

Passivhaus Principles

1. Good solar orientation & compact form

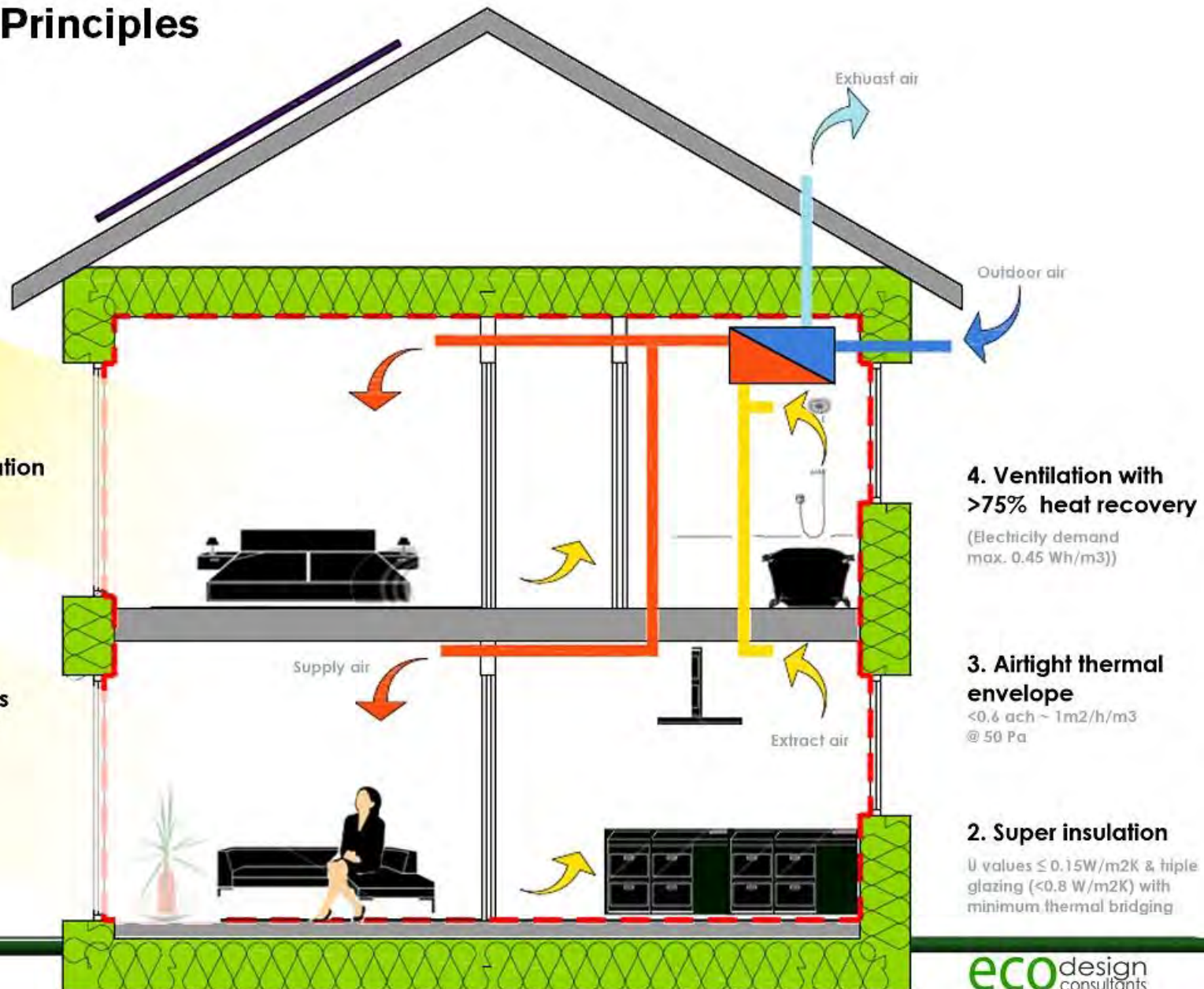
(Specific Space Heating Demand $\leq 15 \text{ kWh/m}^2\text{yr}$ or Heating load $\leq 10 \text{ W/m}^2$)

6. High comfort levels

($\leq 4.2^\circ\text{C}$ surface temperature difference)

7. Low primary energy

$< 120 \text{ kWh/m}^2\text{yr}$



Building Parameters (overview)

- Site Selection
- Orientation for Solar Access
- Multifamily saves exterior walls
- Walls (R70 | U0.081 W/m²K) (**18"** | 46cm)
- Roof (R100 | U0.057 W/m²K)
- Underslab / Basement Walls (**12"** | 30cm **EPS**)
- Windows (R6.5 | U0.85 W/m²K)
- Shading (1m, 0.25m above windows)
- Ventilation (90%+ Effectiveness)

Site Selection

- Solar Access
- Mixed Use Zoning

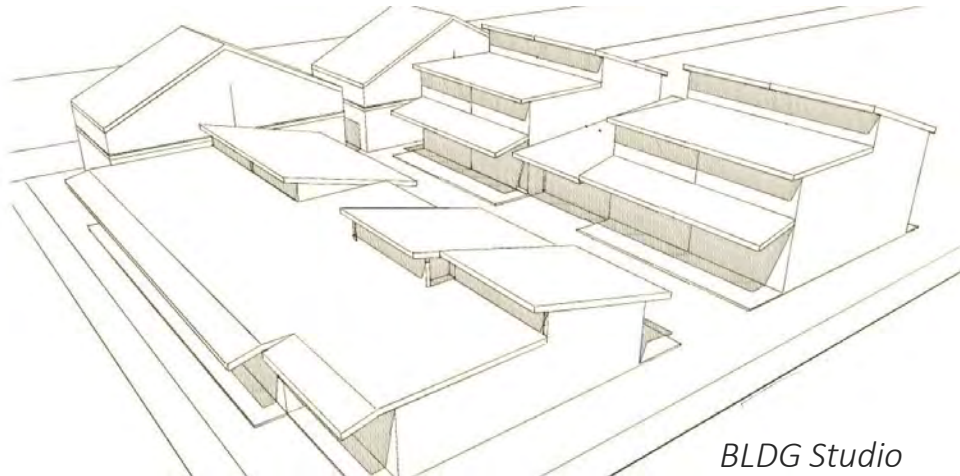


Orientation / Layout

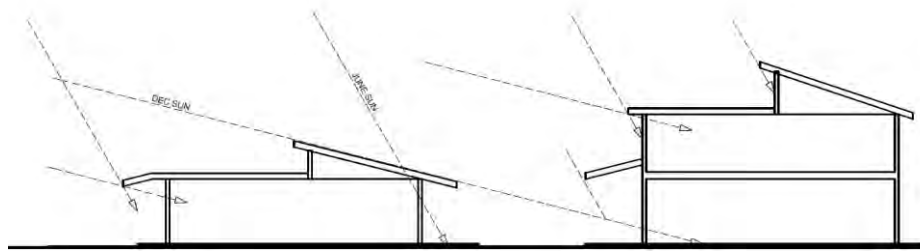
- Somewhat inspired by layout at Vauban
- Oriented so each unit has a south exposure
- Shared party walls save energy
- Rows don't shade each other
- Grade beam on piles at this point, 4" slab on main floor, with no basements
- Except under common house (cold room for vegetables, utilities)
- Would like to keep main floors wheel chair accessible
- Space efficient design
- Keep storage to a minimum



Vauban PlusEnergy Homes

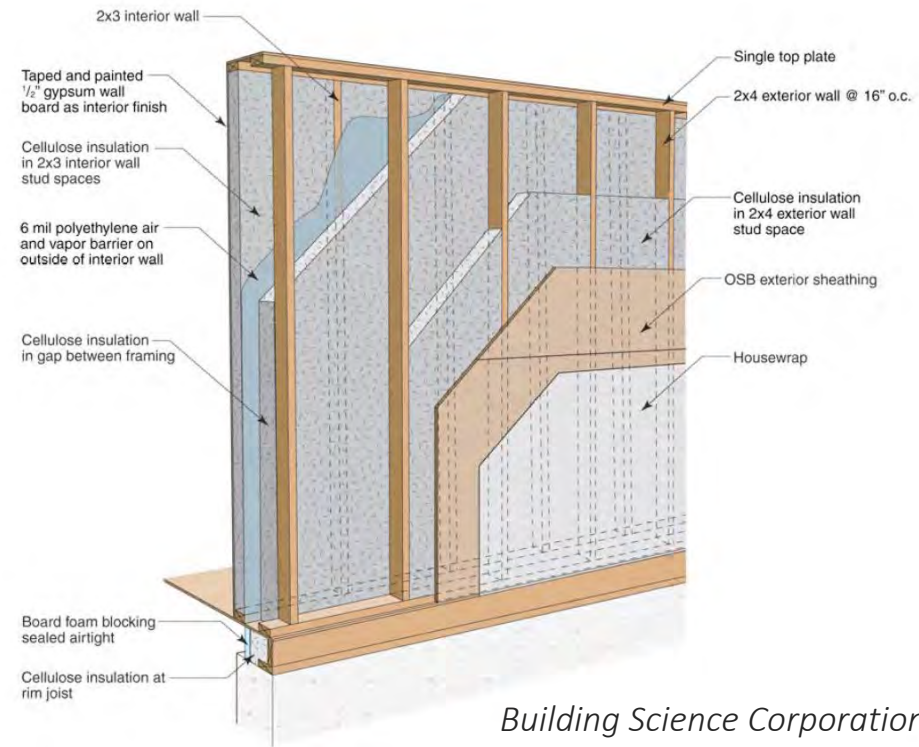


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Walls

- R70 (U0.081 W/m²K)
- 18" – 46 cm
- Examined various wall types:
- **Double stud wall**
 - Concern with air leaks at rim joist (0.6 ACH?)
 - Thermal bridge at floor
 - Service cavity?
 - May revisit
- SIPS
 - Not thick enough
- ICF
 - Amount of concrete (embodied carbon, cost)
 - Not thick enough



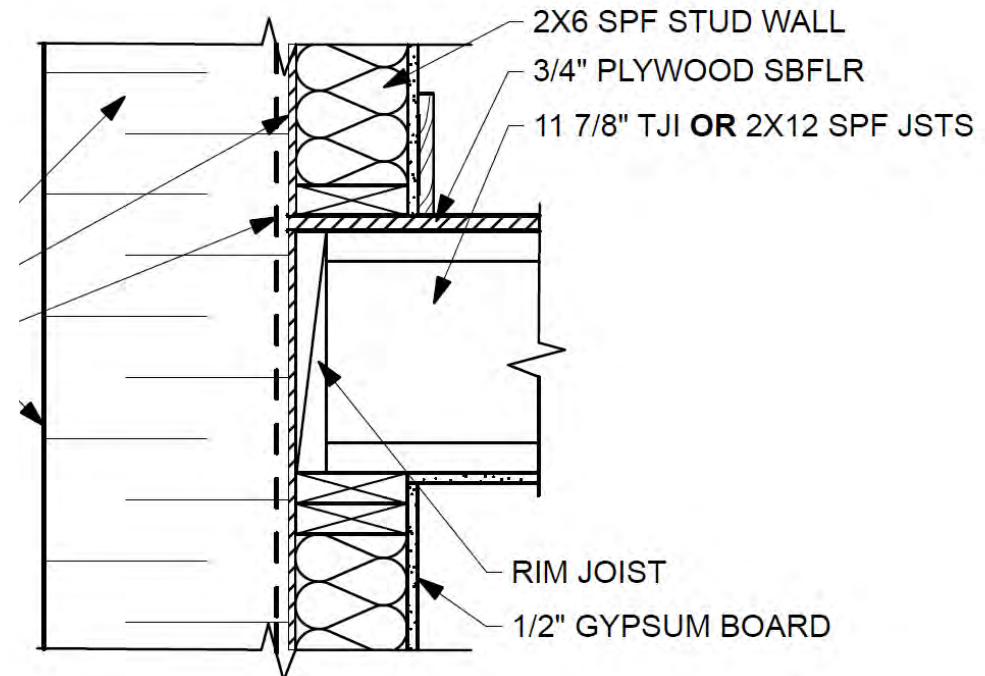
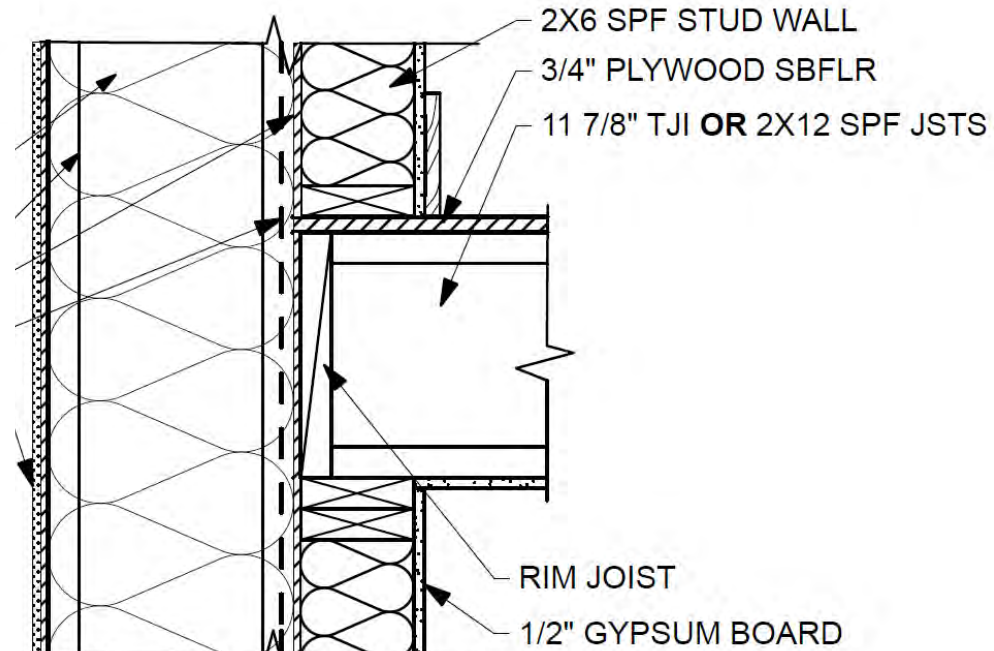
Option 1 Truss Wall

- Total construction budget 216/ft²
- Cellulose insulation derived from natural materials
- Complications coordinating prefab with onsite construction
- More risk in price, more parties involved

Walls

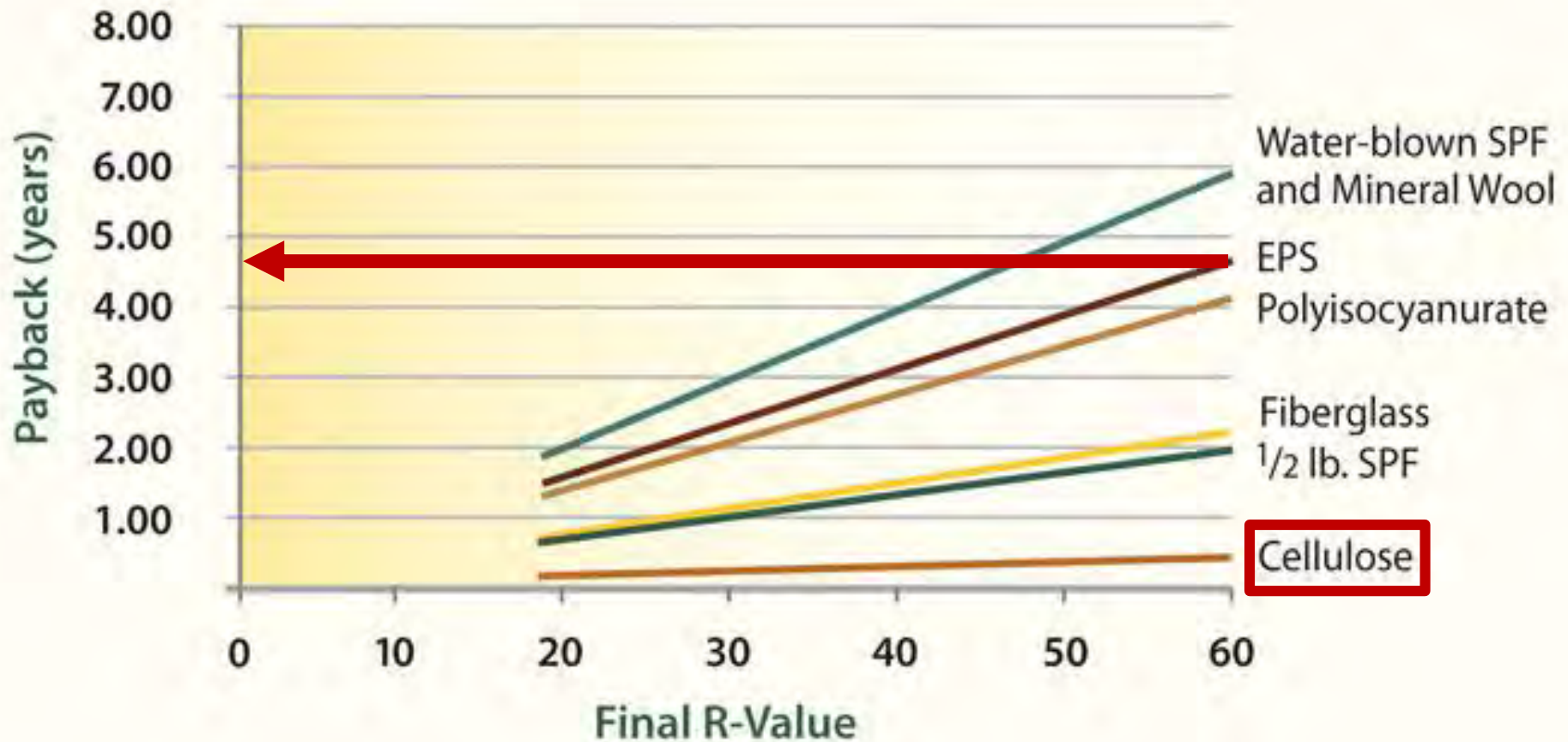
Option 2 EIFS Wall

- Total construction budget 201/ft²
- Lower cost / better affordability
- Simple installation
- Acrylic stucco
- Higher R value
- Embodied energy greatly outweighed by lifecycle heating energy



Insulation – Global Warming Potential Payback

Embodied Carbon + Blowing Agent






Duxton Windows & Doors

ILF12001, Aug. 7, 2012

325 Low Profile Fixed as per EN ISO 10077-2 and EN673

| Glazing | U-Factor Total Window (W/m ² -K) | U frame (head,jamb,sill) (W/m ² -K) | Ψ (W/m-K) | U centre of Glass (W/m ² -K) | SHGC centre of glass | Frame Height (head,jab,sill) (mm) |
|------------------------|--|--|--------------|--|-------------------------|---|
| 272-arg-Cl-arg-180, se | 0.85 | 1.31 | 0.024 | 0.716 | 0.372 | 36.9 |
| 180-arg-Cl-arg-180, se | 0.87 | 1.31 | 0.024 | 0.742 | 0.560 | 36.9 |

Notes:

1. U-value simulations performed according to EN 673 and EN ISO 10077-2 using Therm 6 and BFRG EN 673 calculation spreadsheet
 2. SHGC simulation used Window 6.3
 3. Cl is clear glass
 4. arg is 90% argon, 13mm air gap
 5. 272 is Cardinal's 272 low-e, 3 mm
 5. 180 is Cardinal's 180 low-e, 3 mm
 6. se is Edgetech's Super Spacer (E-class)
 7. The size was 1200mm x 1500mm as per standard North American ratings
 8. See report ILF11001w-g for product information
- 

Ventilation

- Zehnder ComfoAir 200
- 90% effective plus
- Has free-cooling bypass option for night purge
- Electric defrost
- Pinwheel Building Supplies in St. Catharines is importing them from US and selling them
 - \$2700 before shipping and duty
- We are very interested in using their packaged flex ductwork and diffusers
 - Should significantly reduce labour



Certificate

Certified Passive House Component
For cool, temperate climates, valid until 31 December 2013

Category: **Heat recovery unit**
Manufacturer: **Zehnder Group Nederland B.V., 8028 PM Zwolle, NETHERLANDS**
Product name: **ComfoAir 200, ComfoD250, WHR920**

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

This certificate was awarded based on the following criteria:

| | |
|------------------------------|---|
| Thermal comfort | $\theta_{\text{supply air}} \geq 16.5^\circ\text{C}$ at $\theta_{\text{outdoor air}} = -10^\circ\text{C}$ |
| Effective heat recovery rate | $\eta_{\text{HR,eff}} \geq 75\%$ |
| Electric power consumption | $P_{\text{el}} \leq 0.45\text{ Wh/m}^3$ |
| Airtightness | Interior and exterior air leakage rates less than 3 % of nominal air flow rate |
| Balancing and adjustability | Air flow balancing possible: yes Automated air flow balancing: no |
| Sound insulation | Sound pressure level $L_p \leq 35\text{ dB(A)}$ based on a 4 m ² equivalent absorption area not met Here $L_p = 49.0\text{ dB(A)}$ Unit should be installed so that it is acoustically separated from living areas |
| Indoor air quality | Outdoor air filter F7 Extract air filter G4 |
| Frostprotection | Frost protection for the heat exchanger with continuous fresh air supply down to $\theta_{\text{outdoor air}} = -15^\circ\text{C}$ |

Certified for air flow rates of
60 – 150 m³/h

$\eta_{\text{HR,eff}}$
92 %

Electric power consumption
0.42 Wh/m³

Further information can be found in the appendix of this certificate.

www.passivehouse.com 0327vs03

CERTIFIED COMPONENT
Passive House Institute

Passive House verification



| | | |
|----------------------------------|-----------------------|-------------------------------|
| Building: | Radiance Cohousing | |
| Street: | | |
| Postcode/City: | Saskatoon | |
| Country: | Canada | |
| Building Type: | Multi-family | |
| Climate: | SK_Saskatoon (CanPHI) | |
| Home Owner(s) / Client(s): | Radiance Cohousing | |
| Street: | | |
| Postcode/City: | | |
| Architect: | Crystal Bueckert | |
| Street: | | |
| Postcode/City: | | |
| Mechanical System: | | |
| Street: | | |
| Postcode/City: | | |
| Year of Construction: | 2014 | Interior Temperature: 20.0 °C |
| Number of Dwelling Units: | 5 | Internal Heat Gains: 2.1 W/m² |
| Enclosed Volume V _e : | 1708.3 | |
| Number of Occupants: | 18.1 | |

15.3 kWh/m²

by monthly method

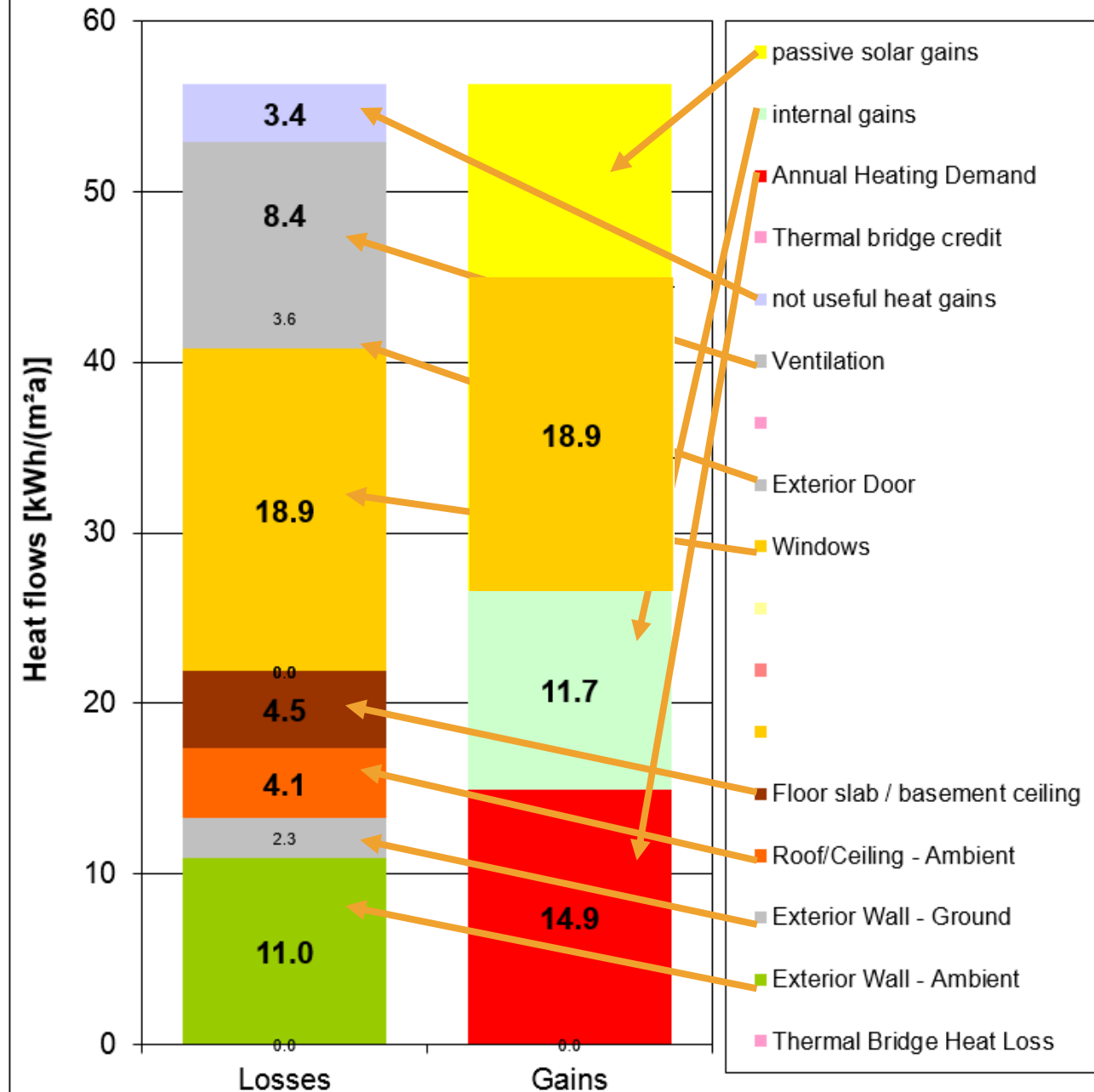
14.9 kWh/m² by annual method

15 W/m² too high to heat only by ventilation air

| Specific building demands with reference to the treated floor area | | | use: Monthly method | | |
|--|---|---------------|---------------------|----------------|-------------|
| | Treated floor area | 632.7 m² | | | |
| Space heating | Annual heating demand | 15 kWh/(m²·a) | Requirements | 15 kWh/(m²·a) | Fulfilled?* |
| | Heating load | 15 W/m² | | 10 W/m² | - |
| Space cooling | Overall specific space cooling demand | kWh/(m²·a) | | - | - |
| | Cooling load | W/m² | | - | - |
| | Frequency of overheating (> 25 °C) | 4.5 % | | - | - |
| Primary Energy | space heating and cooling, dehumidification, DHW, and auxiliary household electricity | kWh/(m²·a) | | 120 kWh/(m²·a) | |
| | DHW, space heating and auxiliary electricity | kWh/(m²·a) | | - | - |
| | Specific primary energy reduction through solar electricity | kWh/(m²·a) | | - | - |
| Airtightness | Pressurization test result n ₅₀ | 0.6 1/h | | 0.6 1/h | yes |

* empty field: data missing; "-": no requirement

Heating energy balance



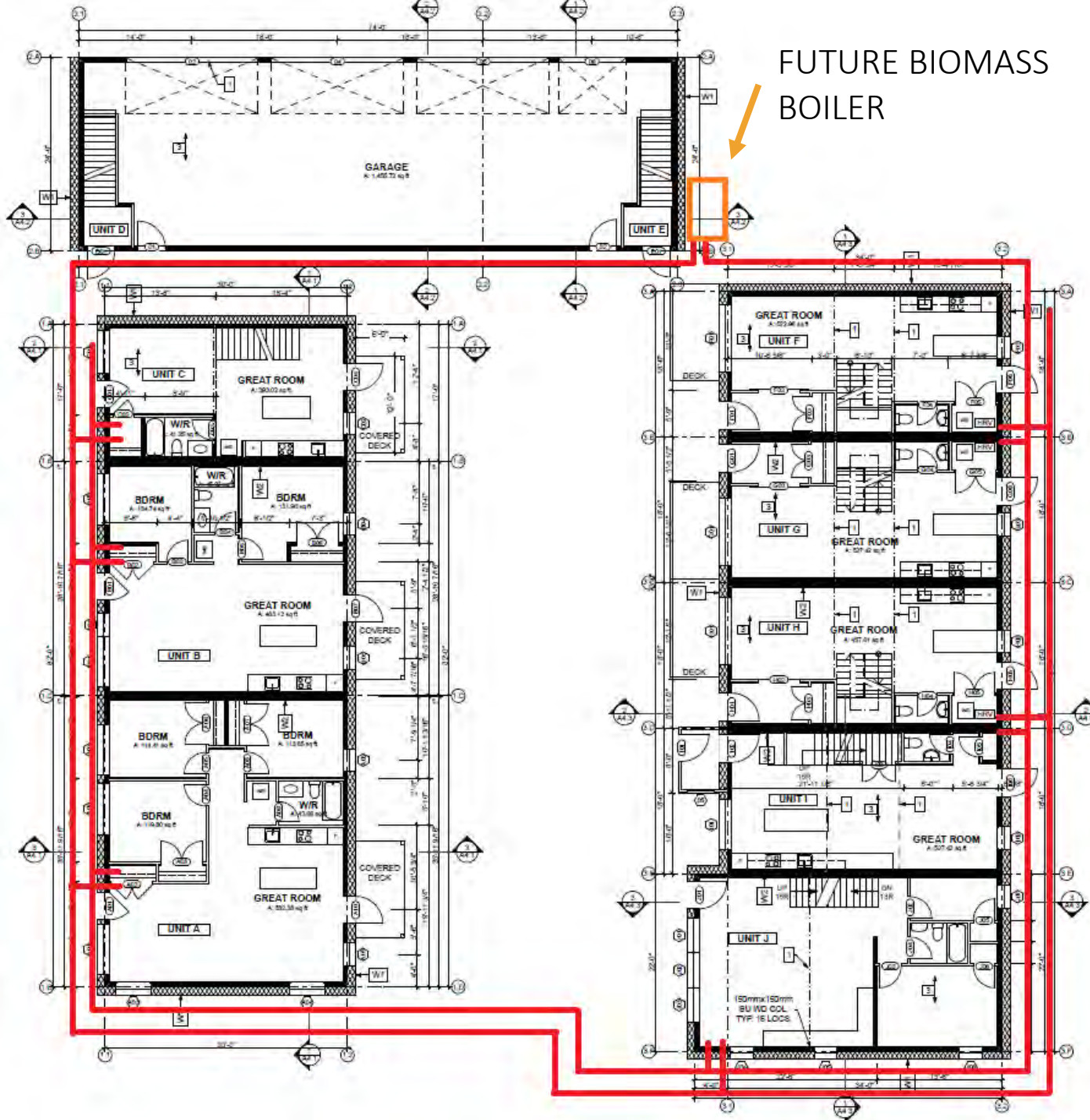
Annual Heating Balance

- Large passive solar gains
- a $55 \text{ kWh}/\text{m}^2$ building

| | Option 1: Electric Heat | Option 2: Gas Furnace |
|---------------------|-------------------------|-----------------------|
| Installed Costs: | TBD | TBD |
| Efficiency: | 1 | 0.95 |
| \$/kWh: | 0.11 | 0.02 |
| Minimum Charge | - | \$1,131 |
| Heating Energy Cost | \$1,039 | \$209 |
| DHW Energy Cost | \$577 | \$116 |
| Annual Cost: | \$1,615 | \$1,457 |

Heating with Electric or Gas?

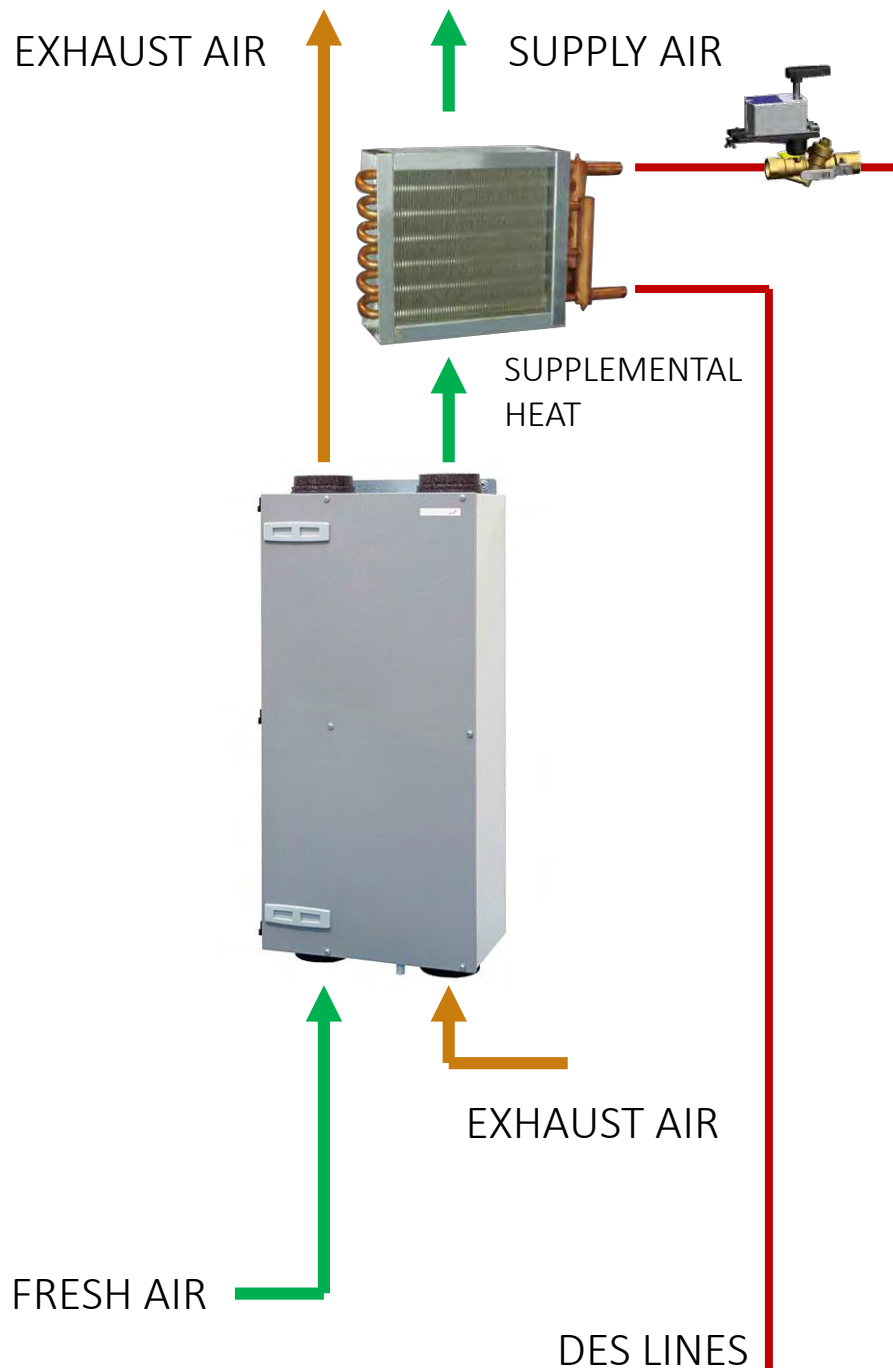
- Electric annual cost is similar to gas, for space heating and domestic hot water
 - (assuming drain water heat recovery)
- This is for the 5 unit – 2+ level building
 - **per unit, per year** -> total - \$1615/5 = \$323, heat only - \$1039/5 = **\$208**
- Electric baseboard is low cost to install
 - Offset power with PV? Green energy investments?
- Electric infloor in bathrooms, etc an option



FUTURE BIOMASS
BOILER

Considering a District Energy System (DES)

- Less costly to install piping along with other site services
- Opportunity to do biomass, gasifier, heat pump...
- Easy way to add some cooling in future
- May only install piping now



Implementation of DES

- Not sized for full load
 - 50% of load meets 80%+ of annual energy
 - Electric will back up
- Lower cost than infloor
 - Comfort of infloor not seen in high performance envelopes
 - *Floor will be ~20°C*
- DHW heating would be supplemented as well

Solar Thermal DHW?

- Our windows are our space heating solar thermal collectors
- For DHW, same cost PV system can be shown to heat more hot water annually
- Despite lower efficiencies with PV, net-metering to the grid is never full – a hot water tank reaches its max temperature often
 - Helps to keep things simpler, easier to maintain, more likely to be repeated.

Getting it built.

- Preliminary drawings and budget pricing complete.
- Proceeding with construction drawings over the winter.
- Aiming to begin construction in the spring.
 - Spring 2016 move in?
- 3 units currently available.

www.radiancecohousing.ca

twitter.com/britebuildings

www.facebook.com/radiancecohousing



