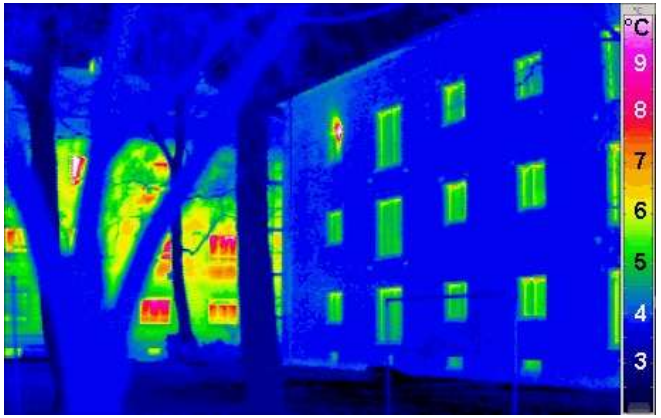
Green Building Roundtable:

Residential and Commercial Applications for Passivhuas

January 18, 2013



Devens Eco-Efficiency Center
Helping firms protect resources.

ECOSTAR

Passive House (Passivhaus)

- “Passive House” - literal translation (poor)
- “haus” not limited to single-family residences – all buildings
- “gasthaus” = inn or hotel, not literally a “guest house”
- Passive not limited to solar heat gain – efficiency

So Passive House standard can be used for all types of buildings

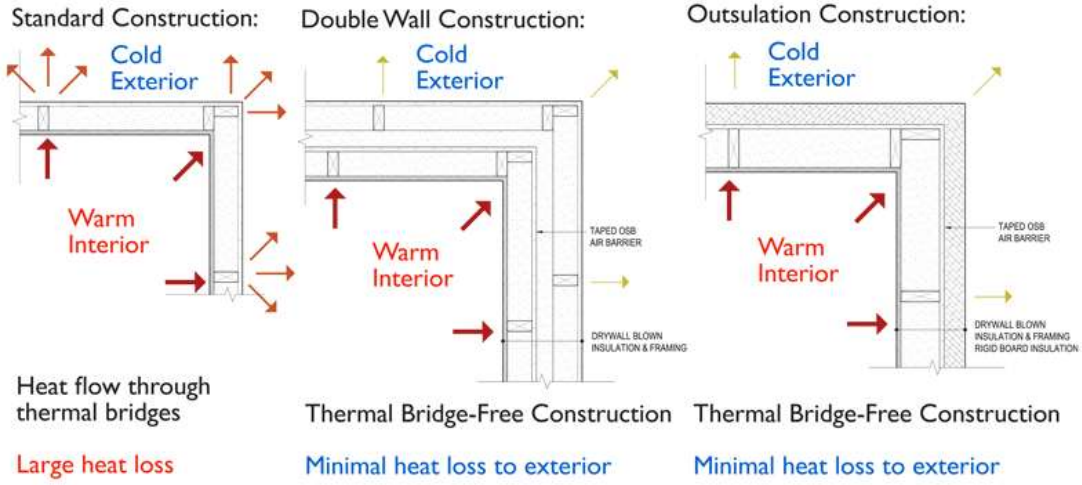
Devens Eco-Efficiency Center
Helping firms protect resources.

5 Key Elements of Passive House Standard

1. super-insulated, air-tight – consistent temp. control

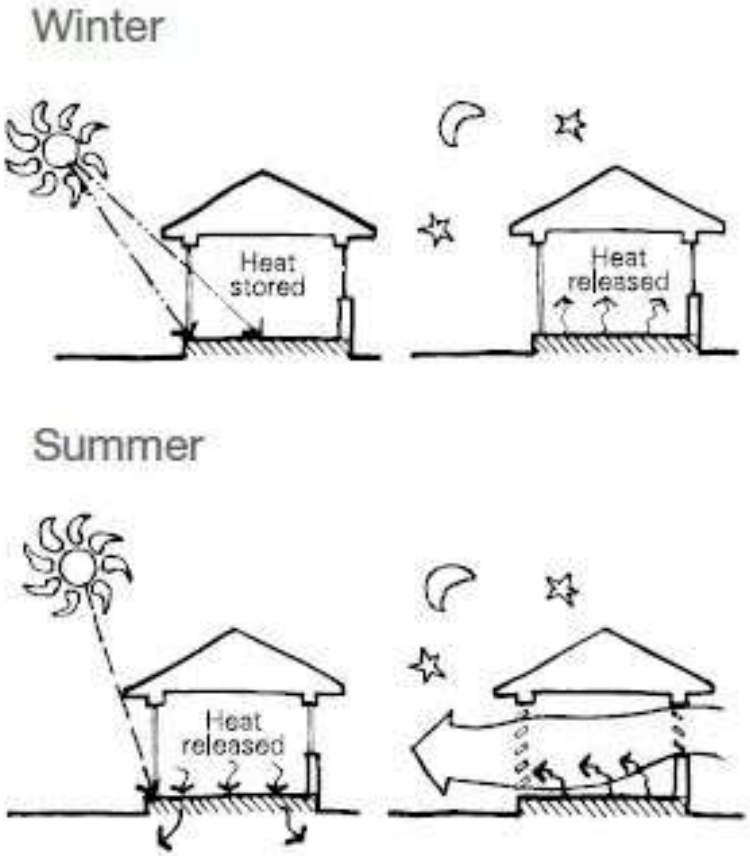
5 Key Elements of Passive House Standard

2. EE Windows & reduced thermal bridging



5 Key Elements of Passive House Standard

3. Passive solar heat gain & internal gains from thermal massing, people, electrical equipment, etc.



Devens Eco-Efficiency Center
Helping firms protect resources.

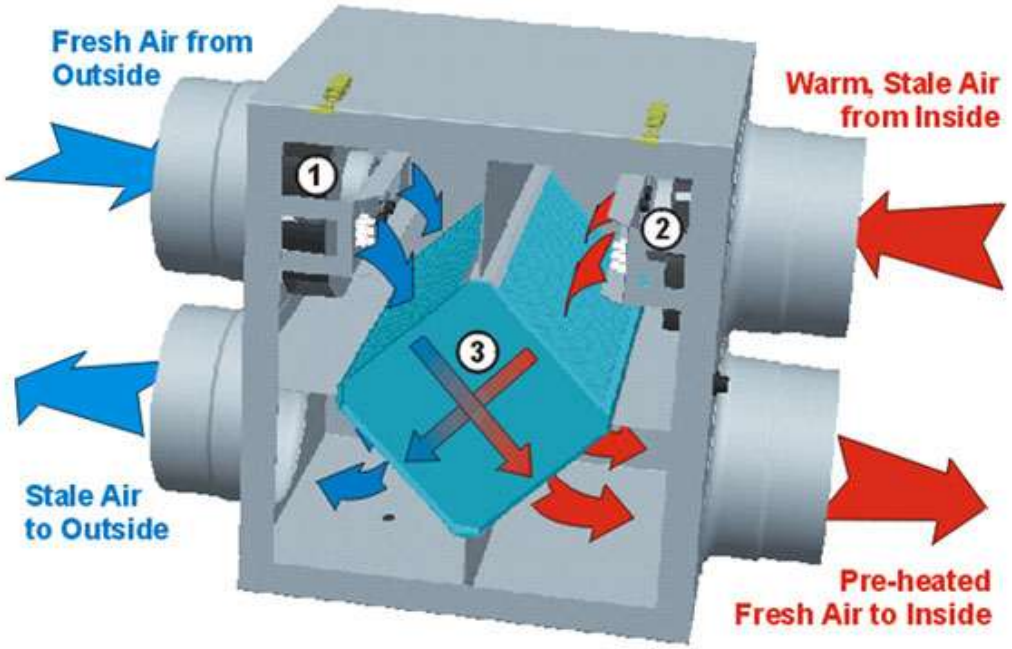
5 Key Elements of Passive House Standard

4. Avoidance of heat gain and reduction of cooling load through shading and window orientation

Devens Eco-Efficiency Center
Helping firms protect resources.

5 Key Elements of Passive House Standard

5. HRV or ERV's - balanced fresh air supply (EE and great IAQ)



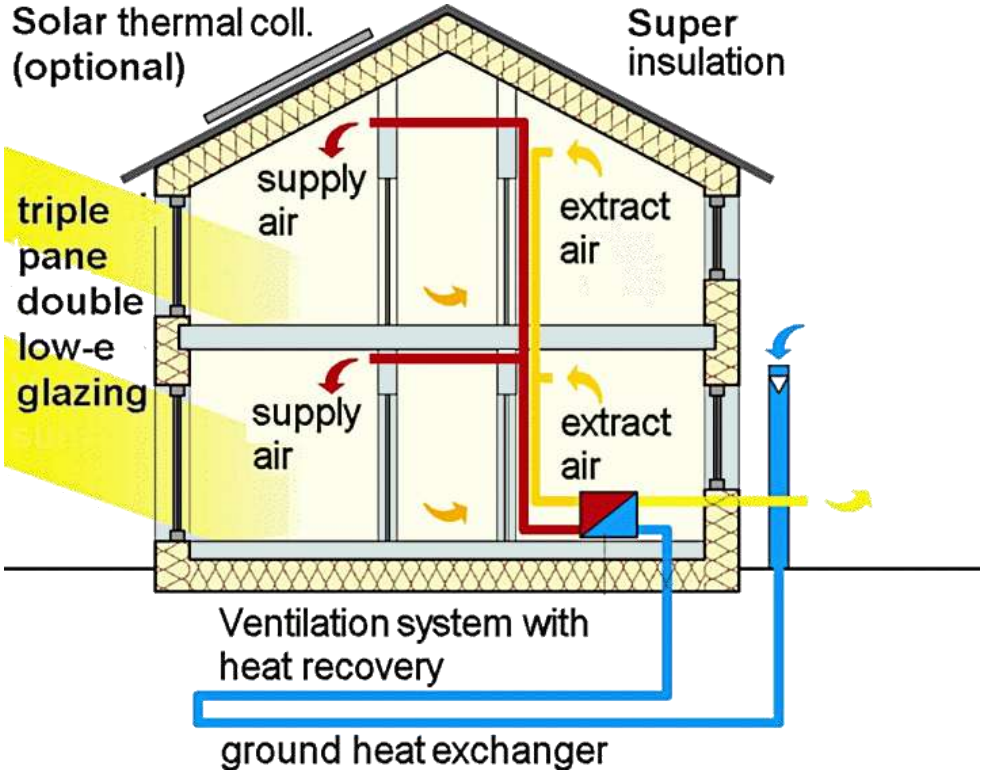
Passive House Performance Characteristics

Super insulation:

- High R-Value or Low Thermal Heat Loss Coefficient **-** R-Values of 38 - 52 on all external walls, slab foundation and roofs.
- Construction Reducing Thermal Bridging
- Airtight Construction

High Efficiency Windows:

- R-Value of just over 7 (U-value of <0.20) using triple pane windows with two low-e coatings and Argon gas (Energy Star window in the US will be closer to 0.30)
- Super-insulated frames
- “Warm Edge” spacers between the panes of glass



Devens Eco-Efficiency Center
Helping firms protect resources.

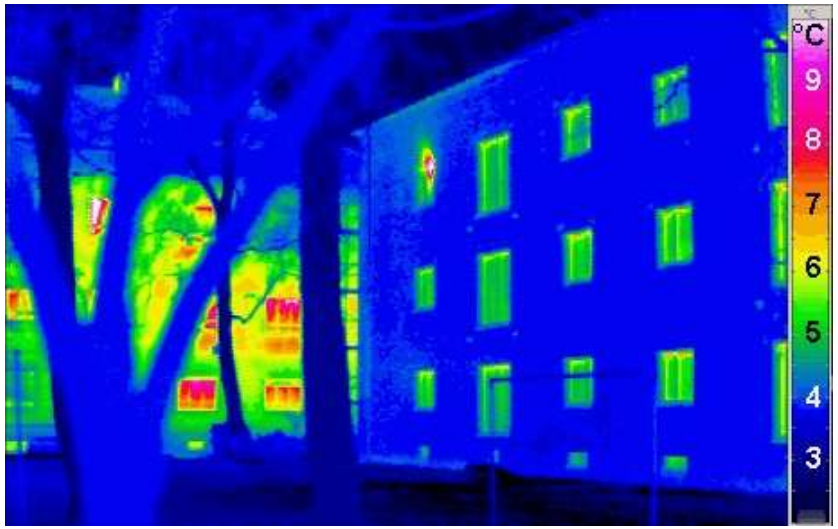
Passive House Performance Characteristics cont….

Mech. Ventilation w/ Heat Recovery

- HRV or ERV recover 75% to 95% of the heat by passing warm exhaust air past the incoming cold air without mixing - only fresh air is vented into the home and no air is recirculated.

Inno. & Efficient Heating Technology

- Small heat pump
- Small condensing gas burner
- Small combustion unit for biomass fuel
- Compact unit for all in one heating, ventilation and domestic hot water



Specific Heating Demand	≤ 15kWh/m².yr
(or) Specific Heating Load	≤ 10W/m²
Specific Cooling Demand	≤ 15kWh/m².yr
Specific Primary Energy Demand	≤ 120kWh/m².yr
Airtightness	≤0.6ach @50pascals (n50)

Passive House Performance Characteristics cont….

	Code Built	Energy Star	Super Insulation	Passive House*
Walls	**R-20**	**R-25**	**R-40**	**R-60**
Roof Slopes	**R-38**	**R-40**	**R-60**	**R-80**
Flat Ceiling	**R-49**	**R-50**	**R-80**	**R-100**
Foundation / Slab**	**R-10**	**R-13**	**R-20**	**R-40**
Windows***	**R-2.9**	**R-3**	**R-5**	**R-7.5**
Air Leakage (nach)****	**0.5+/-**	**0.3**	**0.05**	**0.03**
HERS Rating	**100**	**85**	**30**	**20**
Home Heating Index (Btu/Sqft / HDD)	**7**	**5**	**1.5**	**0.5**

Notes: * Passive House R-values and air leakage numbers are site specific

**** *Foundation / Slab R-values are for under slab and for below grade wall areas***

******Window R-values are for entire unit including the frame***

*******Air Leakage is in natural air changes per hour, no code built requirement***

Devens Eco-Efficiency Center
Helping firms protect resources.

Passive House Residential & Commercial Examples

Glasswood Passive House Commercial Retrofit

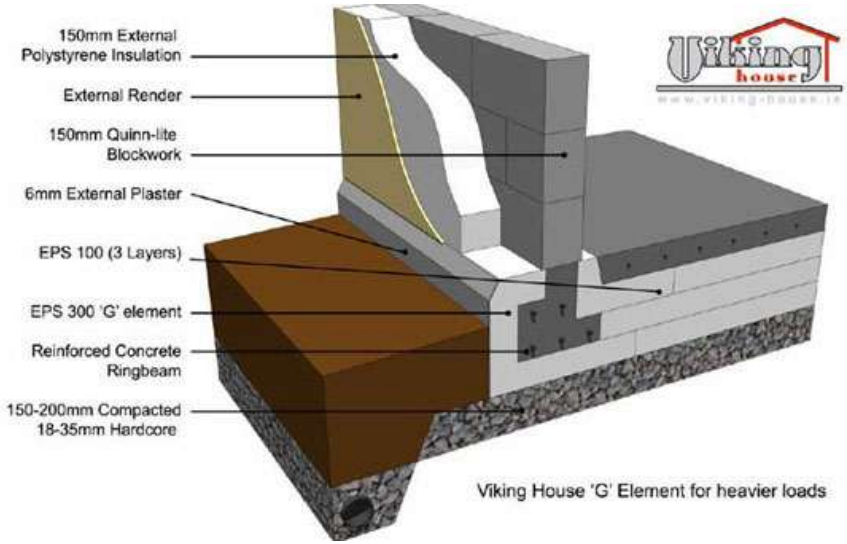
- first commercial passive house retrofit in US
- office upstairs and restaurant downstairs.
- building retrofit (embodied energy/LCA)

http://hammerandhand.com/glasswood-passive-house-retrofit

Viking House

- 1400 sq.ft Commercial Building – Dublin, Ireland

http://www.viking-house.co.uk/1st-passive-certified-commercial-development.html#



Passive House Residential & Commercial Examples

- **Rolf Disch – Solar Architect – Sonnenschiff**, Freiburg, Germany

- Others?

Devens Eco-Efficiency Center
Helping firms protect resources.

LEED vs. Passivhaus?

LEED	Passive House
Energy (25-30% less than conventional)	Energy (60-90% less than conventional)
Air Quality (integrated)	Air Quality (basic)
Tightness (no min. ACH)	Tightness (0.6 ACH @ 50 Pascal-10x tighter than ES)
Complex systems	More basic
Generalized standard	Location and climate specific
Builder/owner preferences	Standardized
Atmosphere, Water, Site, Materials,	Energy

Devens Eco-Efficiency Center
Helping firms protect resources.

Great Ideas – But How do I Pay for them?!

Passive Energy Funding Opportunities.

Energy Star Rebates for Homeowners (envelope improvements, roofing, HVAC upgrades, boilers, renewable energy systems, fuels cells and more)
http://www.energystar.gov/index.cfm?c=tax_credits.tx_index#c2

Tax deductions for new or existing commercial buildings ($1.80/sq.ft) that achieve 50% energy reductions and meet ASHRAE 90.1-2001. Also partial deductions for Building system improvements (envelope, lighting, HVAC)
http://www.energystar.gov/index.cfm?c=tax_credits.tx_comm_buildings

Industrial Energy Assessment Assistance (manufacturing facilities)
http://www1.eere.energy.gov/industry/saveenergynow/

Federal Incentives for Renewables and Efficiencies in Massachusetts
http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=MA

Devens Eco-Efficiency Center
Helping firms protect resources.

Passive Energy Funding Opps. Cont…

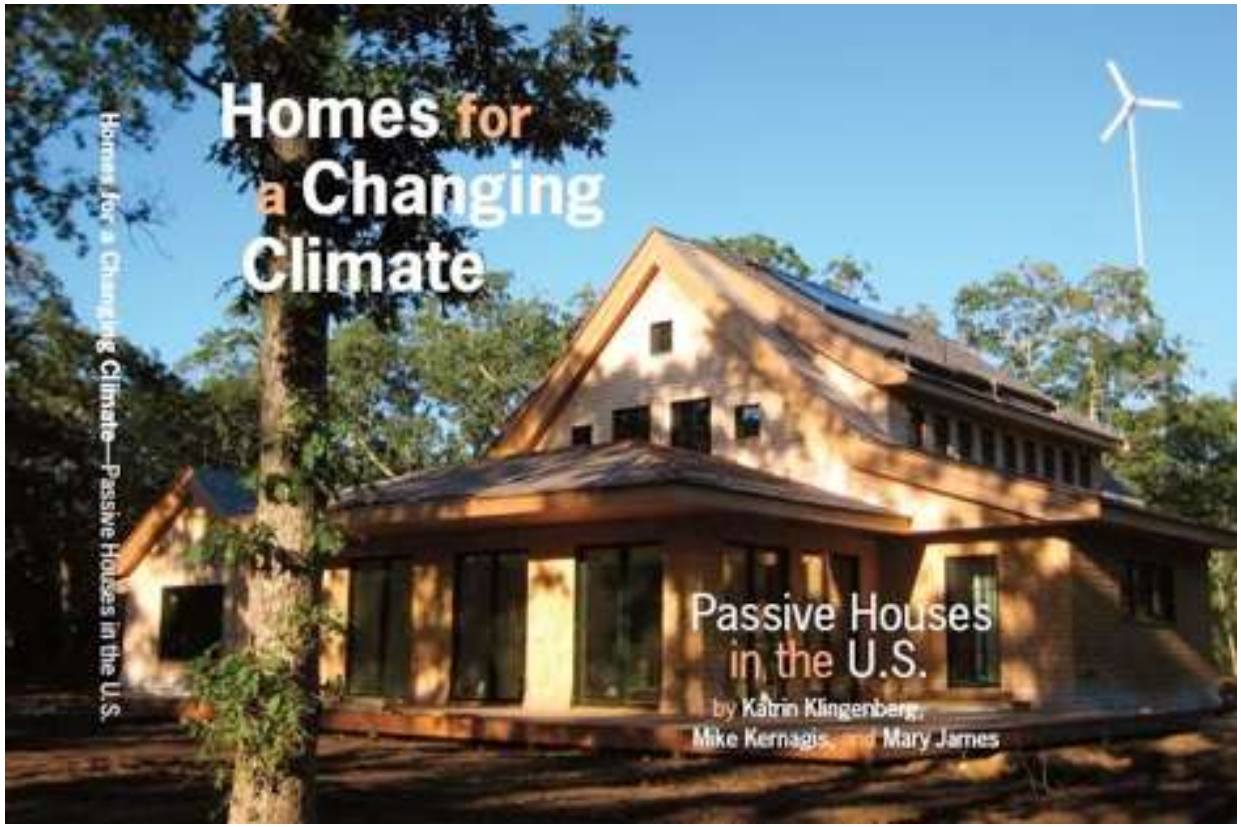
Demand Response Program (ISO New England)
http://www.iso-ne.com/genrtion_resrcs/dr/index.html

UMASS Lowell – Industrial Assessment Center (EE for small-med sized companies >500 employees, <$100m annual sales, no in-house energy expert, annual energy costs between $100K and $2.5m)
http://www.ceere.org/iac/index.html

CHP for the Northeast – Assessment and Analysis Support
http://www.northeastchp.org/

National Grid Whole Building Assessment Program
http://www.nationalgridus.com/non_html/WBAMOU_Final_5_22_09.doc

Passive House Resources



US Passive House Institute – information, design tools, good overall resource

Passvie House Institute US – Certification Program:

http://www.passivehouse.us/passiveHouse/PHIUSHome.html

Passive House Resources

Passive house overview - http://www.passivhaustagung.de/Passive_House_E/passivehouse.html

Passive Solar Heating and Cooling – good summary of elements http://www.iklimnet.com/save/passive_solar_heating.html

Rolf Disch Solar Architect - http://www.rolfdisch.de/

Overview of **Passive Solar** Design concepts http://passivesolar.sustainablesources.com/

Others??

Devens Eco-Efficiency Center
Helping firms protect resources.