

# Comparison of Conventional vs. Highly Energy Efficient Design

“Designing & Building a Zero Annual Net Energy House” – NESEA Building Energy Conference 2007

Construction Element	Standard	Standard Plus	Moomaw — Hyper Efficient
Attention to meet standards	MA code minimum	Energy Star or LEED	Zero Net Energy
ITEMS RELEVANT TO OPERATIONAL ENERGY			
Fuel supply	100% Power company and oil/gas	Power company and oil/gas with fractional contribution for PV (and maybe solar hot water)	100% solar conversion (PV)
Passive solar (orientation and glazing)	Random orientation and not particular attention to window positioning	Within 25 degrees of solar south, more than half of the window glazing on south side. No dedicated thermal mass.	Solar south, more than half of the window glazing on south side. No dedicated thermal mass.
ENVELOPE COMPONENTS			
Sub-slab...and slab edge	No sub slab insulation	At least 1” of sub-slab XPS insulation to avoid summer time condensation of slab surface	1” of sub-slab insulation (EPS)
Wall system (below grade)	Concrete — f.g. insulation batts in floor plane over basement	Foundation walls insulated to the interior — 2 x 4 wall with f.g.batt cavity insulation (R9±)	Foundation walls insulated (to interior) with 3” foil-faced polyiso. insulation continuous — (R18.5)
Wall system (above grade)	Fiberglass batts in stud cavity — probably imperfectly fitted; a code minimum standard. (Supposed to be R 20± but usually R 12±)	.... add strap horizontally w/ 2 x 3 for a 7” cavity with cellulose blown-in insulation (R 23±) OR add 1 ½” or 2” rigid foam exterior (or interior) wrap R25±	Double wall w/ Larsen truss 12” thick cellulose R40, or Double 2x4 wall 12” thick (guest house) R40
Windows and Doors	Wood double pane double hung, argon filled low E (U=0.35)	Wood double pane argon filled low E with third panel. (U=0.25)	Fiberglass triple pane casements with 2 argon-filled low E warm edge, insulated frame and sash. (U=0.19)
Roof/ceiling plane	Loose fill cellulose shoveled into	..... by with a 12” truss heel —	... 20” depth with full height truss

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	ceiling but often with a thermal bridge at the perimeter cause by the absence of the “truss heel” (R35)	and perhaps additional depth (this is very inexpensive insulation with no threshold barrier (R 40)	heel (R70) OR Hot Roof – 12” cellulose in TJI rafter cavities w/ 1 ½” foil-face polyios continuous below (R48±)
Overall Air tightness	0.5± ACH (natural);	Energy Star – blower door tested ELA 1.0 sq. in./100s.f. shell area (0.2 ACH natural)	Ultra tight – blower door tested ELA 0.5 sq. in./100s.f. shell area (0.08 ACH natural)
<b>BUILDING (Mechanical) SYSTEM COMPONENTS</b>			
Heating system/ventilation system	Central furnace (hot air) or boiler (baseboard hydronic); often NOT sealed combustion; high wattage burner/fan motors;	..... with sealed combustion furnace or boiler, more energy efficient – ECM motors; low mass boiler;	GSHP with radiant floor designed to function with low temp water; minimal static loses in circulatory tubing and pumps sized accordingly; variable speed motors..... (and other intelligence that I’ll need reminding about)
Heat recovery – exhaust air	None	Basic HRV system. Mechanical ventilation system without energy recovery features.	ERV with attention to motor and energy recovery efficiency.
Plumbing	Branched distribution	Branched distribution	‘HomeRun’ distribution with PEX ... with what was supposed to be narrower bore conduits holding less water
Heat recovery – gray water	None	None	‘PowerPipe’ on shower most used – 6’ length recovery 50%± of outgoing “heat”
Appliances	Low cost choice without attention to wattage	Energy Star – many appliances with energy consuming “extras”	Fewer appliances chosen by low kwh consumption.
Light fixtures	Basic provision of surface	Ample lighting, often too much	Attention to wattage/fluorescent

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	mounted fixtures; incandescent lamps; on-off controls; no particular concern to avoid violating the insulation/air seal.	installed wattage and many recessed fixtures penetrating insulation/air seal	and CFL; multi-switching, dimmers and auto-off controls; no recessed lighting in insulated space.
ITEMS WITH SOURCING AND CHEMICAL and/or EMBODIED-ENERGY RELEVANCE			
<b>Construction Element</b>			
Roofing	Asphalt (20 yr.)	Asphalt (40 yr)	Metal standing seam
Siding	Cedar shingles	Hardiplank fiber cement boards	Hardiplank fiber cement boards
Adhesives, sealants, glues	Contain VOCs	Non-toxic	Non-toxic NO VOC
Concrete	Cement w/ diesel oil release	St Lawrence 'Gran-Cem' w/ diesel oil release	St Lawrence 'Gran-Cem' w/soy oil
Plumbing	Copper and PVC	Copper and cast iron	PEX/copper and ABS
Finish carpentry (casings, baseboard)	Standard finger-jointed primed poplar	Standard unfinished poplar, oak or maple	Sustainably harvested and/or locally obtained hardwoods
Decking	Pressure treated wood (CCA)	Pressure treated (ACQ or durable lumber)	Plastic lumber or sustainably harvested durable lumber
Paints	VOC containing	Low VOC	NO VOC
Flooring	Wall-to-wall carpet or vinyl	Hard wood (finished on-site), tile, cork	Prefinished Hard wood, tile, cork
Electric and plumbing conduits	PVC	PVC	HDPE