

## Ecofutures Zero Energy New and Remodeled Homes, 2005 and Beyond as of September 2009

	A	B	C	D	E	F	G
	<b>Solar Harvest (SH) North Boulder</b>	<b>Broomfield Near Zero Net Energy Home</b>	<b>South Boulder Zero Net Energy Remodel</b>	<b>Indian Hills Zero Net Energy Home</b>	<b>Evergreen Zero Net Energy Home</b>	<b>Lake Valley Zero Net Energy Home</b>	<b>Fraser ("Icebox of the Nation") Net Producer</b>
<b>Move-In Dat (Mo./Yr.)</b>	Nov. 2005	May 2008	Oct. 2007	May 2008	March 2009	Future (August 2010)	Future (August 2010)
<b>New or Retrofit / Yr. Built / Elevation / Heating Degree Days (HDD)</b>	New / 2005 / 5,450 ft. elevation / 5,200 HDD	New / 2007 / 5,390 ft. elevation / 5,200 HDD	Retrofit / 1970 / 5,600 ft. elev. / 5,200 HDD	New / 2007 / 7,500 ft. elev. / 8,500 HDD	New / 2007-8 / 7,700 ft. elev. / 8,500 HDD	New / 2009 in design / 5,200 ft. elevation / 5,200 HDD	New / under construction / 8,700 ft. elevation / 10,500 HDD
<b>Conditioned SF</b>	4,600	6,800	2783 (2068 existing incl. basement + 713 new)	4,700	3,500	5,200	5200 (w/ heated 700 garage) + 900 detached shop
<b>Approx. Design Heat Load (BTUs/hr) @ degF</b>	29,000 @ 2F	45,000 @ -5F	22,000 @ -5F	40,000 @ -10F (includes 30% warm-up factor)	25,000 @ -10F	35,000 @ 0F	52,000 @ -14F
<b>Passive Gain (Hi / Med / Low)</b>	High, into sunspace; heat distributed w/ fans and ducts	Very Low (2 windows of 56 in house)	Low	High	Medium	High, into sunspace; heat distributed w/ fans and ducts, medium into S windows	High, into sunspace; heat distributed w/ fans and ducts, high into S windows
<b>S Glazing: SHGC, and as % of floor area</b>	0.62 in sunspace; 0.54 elsewhere / 7.3%	0.27 / 0.4%	0.48 / 4%	0.62 / 8.8%	0.62 / 5%	0.82 in sunspace; 0.55 elsewhere / 9.7%	0.82 in sunspace; 0.35 elsewhere / 12%
<b>E &amp; W Glazing: SHGC; built &amp; natural shading</b>	0.27 / new aspen trees on E; 4 pm +, by existing neighbor's trees	0.27 / Porch overhangs on 60% of glazing; no natural shading	0.27 / 50% tree shading	0.27 / No trees yet	0.27 / 30% tree shading; roll-down shutters on W (wind protection; traffic noise; thermal insulation; shading)	0.28 / high windows with overhangs, trees to be located as necessary	0.27 / few trees
<b>Envelope: Framing, Insulation All Assemblies Thermally Broken (RC=1.5" Resilient Channel)</b>	Walls: 1" ext. Blueboard; 2x6 with 1.5" RC; 7" Icynene. Ceiling/Roof: 12" Icynene on top of drywall, 12" Icynene below roof sheathing	Walls: 1" ext. expanded polystyrene (EPS); 2x6 w/RC; 7" Icynene. Ceilings/Roofs: >12" Icynene w/RC	Walls: Remove brick; add 2x4 ext. wall; Icynene. New construction: 2.x6 wall w/RC, Icynene-filled for 7" total. Ceilings/Roofs: 7" Icynene on top of drywall + 8" Cellulose; R70 SIPs + Icynene	Walls: 1/2" ext. expanded polystyrene (EPS); two 2x4 walls w/ 1/4" separation; 7 1/4" Icynene. Ceilings/Roofs: 12" Icynene on top of drywall; 12.5" Icynene w/RC	Walls: 2" ext. expanded polystyrene (EPS); 2x6 w/ 5.5" Icynene. Ceilings/Roofs: 14" Icynene under sheathing + avg. 2" EPS above sheathing	Walls: 1" EPS foam ext; 2x6 w/1.5" RC; 7" Icynene. Ceilings/Roofs: 12" Icynene w/RC	Walls: 3" EPS foam ext; 2x6 w/1.5" RC; 6.5" closed cell spray in place foam. Ceilings/Roofs: 12" closed cell
<b>Envelope: Windows</b>	Fibertec; Heat Mirror (dbl. on north); tuned	Fibertec; triple pane w/ LowE	Fiberglass frames by Duxton, thru Alpen; double Heat Mirror throughout	Loewen wood clad windows with triple-pane glazing, tuned	Fiberglass frames by Duxton, thru Alpen; double Heat Mirror throughout	Fiberglass frames by Duxton, thru Alpen; double Heat Mirror throughout. Avg U-.16	Fiberglass frames & double Heat Mirror glazing by Serious Windows. Avg U-.16
<b>Envelope: Air Tightness (NACH = Natural Air Changes per Hour)</b>	Very tight: 0.09 NACH	Very tight: 0.08 NACH	Tight: ~0.2 NACH	Very tight: 0.11 NACH	Very tight: 0.07 NACH	Very tight: 0.08 NACH	Very tight: 0.08 NACH
<b>Indoor Air Quality / Heat Recovery</b>	Low-emissions building materials; Stirling ERV (**Sensible Recovery Efficiency: 83-81)	Low-emissions building materials; Stirling ERV (**Sensible Recovery Efficiency: 83-81)	Low-emissions building materials; Stirling ERV (**Sensible Recovery Efficiency: 83-81)	Low-emissions building materials; Stirling ERV (**Sensible Recovery Efficiency: 83-81)	Low-emissions building materials; Enerboss Clean Air Furnace with ERV core (**Sensible Recovery Efficiency: 74)	Low-emissions building materials; ERV integral with Enerboss or Lifebreath AHU	Low-emissions building materials; Stirling ERV (**Sensible Recovery Efficiency: 83-81)
<b>Thermal Mass</b>	Double 5/8" drywall throughout (all walls & ceiling planes) for indirect, distributed mass	Double 5/8" drywall throughout	1.5" Gypcrete throughout (existing, with radiant floor tubes)	Double 5/8" drywall throughout	Double 5/8" drywall throughout	Double 5/8" drywall throughout	Double 5/8" drywall throughout; 2" concrete slabs w/radiant heat
<b>Utilities</b>	Natural gas for cooking & clothes drying/therms offset 2005-2007; All-electric after July 2007/natural gas removed	No natural gas to home	No natural gas to home	No natural gas to home	Natural gas only for cooking	No natural gas to home	No natural gas or propane to home
<b>Onsite Renewables: Electricity (solar et.al.) rated capacity; ~annual production</b>	8.74 kW; 12,586 kWh; net excess 200 kWh, 1st year (with 6.84 kW array)	10 kW; 14,400 kWh	6.04 kW; 8,500 kWh	10 kW; 14,400 kWh	10 kW; 14,400 kWh	10 kW PV; 14,400 kWh	17 kW PV; 23,800 kWh
<b>Anticipated Annual Household Consumption</b>	10,000 kWh/year thru 2007; 9,500 kWh/year 2008+	15,000 kWh/year	8,900 kWh/year	14,000 kWh/year	12,000 kWh/year	14,400 kWh/year	26,500 kWh/yr (house + shop + charging EV)
<b>Amenities / Notable "Extracurricular" End Uses</b>	Outdoor spa + steam shower + fish tank (removed 1/08)	Coolerados + large home office + woodshop + electronics shop + room full of automation & control	None, besides vehicle charging. Current usage ~320 kWh/mo.; w/ addition, ~375; expect <1,500 kWh/yr for backup heat	Outdoor spa + vehicle charging + steam shower	Outdoor spa + waterfall (~1000W continuous)	Outdoor spa	Charging Tesla Roadster & 5-door Tesla when on market (~2,800 kWh/yr to drive ~15,000 miles)
<b>Onsite Renewables: Solar Thermal, w/ Collector Tilt Angle &amp; Heat Rejection</b>	12 - 4x8 Novan flat plate collectors, @ 55 deg tilt; sunspace air distributed w/ fans & ducts	240 Thermomax evacuated tubes, @ 65 deg tilt; summer heat rejection with roof-mounted fin tubes	180 Thermomax evacuated tubes, @ 55 deg tilt; summer heat rejection with roof-mounted fin tubes	180 Thermomax evacuated tubes, @ 37 deg; summer heat rejection with roof-mounted fin tubes	180 evacuated tubes, @ 60 deg; summer heat rejection with roof-mounted fin tubes	4 4x8 solar thermal panels mounted in sunspace at 60 deg. tilt; sunspace air distributed with fans and ducts	240 Thermomax evacuated tubes, @ 65 deg tilt; summer heat rejection with roof-mounted fin tubes
<b>Solar Storage Tank (used stainless steel dairy industry tanks unless otherwise noted)</b>	6,000 gallons, Atmospherically vented + site-built	600 gallons	360 gallons	1,500 gallons	2,000 gallons	400 gallons; fiberglass	1500 gallons; fiberglass
<b>Space Heat Backup &amp; Distribution</b>	Staple-up radiant tubes, w/ >120F water from 6,000 gallon tank; sunspace heated air w/ fans & ducts; 20 gal electric water heater backs up under floor radiant	Fan coils w/ solar- or boiler-heated water; Coolerados as Air Handling Units (blowers); Sunny Day Bypass setup	In-slab radiant tubes throughout; can use 95 deg heat from evac. tubes, w/ Sunny Day Bypass setup	Sunspace heated air w/ fans & ducts; fan coils w/ solar- or boiler-heated water; ECM var. spd. AHU	EnerBoss + ductwork for HRV & heat distr.: Fan coil w/ solar- or boiler-heated water	Fans & ductwork from sunspaces; Enerboss or Lifebreath and ductwork with hydronic coil for boiler-heated water	Sunspace heated air w/ fans & ducts; Radiant tubes in 2" concrete slabs; water-to-water heat pump w/loop field being solar storage tank
<b>Water Heating (DHW)</b>	Heat exchanger coils in solar tank (+ 40-gallon elec. water heater as backup ~8 days during 2006-7 record-breaking winter)	Heat exchanger coils in solar tank + electric boiler to boost solar-preheated water as nec.; expected 100% solar supply of DHW	Heat exchanger coils in solar tank + electric boiler to boost solar-preheated water as nec.; expected 100% solar supply of DHW	Heat exchanger coils in solar tank + electric boiler to boost solar-preheated water as nec.; expected 100% solar supply of DHW	Heat exchanger coils in solar tank + natural gas modulating boiler to boost solar-preheated water as nec.; expected 100% solar supply of DHW	Heat exchanger coils in solar tank + 50-gallon elec. water heater with AirTap backup	Heat exchanger coils in solar tank + heat pump to boost solar-preheated water as nec.; expected 100% solar supply of DHW
<b>Cloudy Cold Snap Heating Backup (usually needed on day 3 of cloudiness; Charge &amp; Coast system covers cold cloudy days 1 &amp; 2)</b>	Heat stored in tank + ~300 kWh/yr (2006-7 record-breaking winter) by 20-gal. water heater to boost radiant floor water temp. to 120F	Thermolec elec. tankless boiler, 15 kW, modulating; expected ~4,000 kWh/yr usage (PVs generate excess in summer; buy back in winter)	Thermolec elec. tankless boiler, 9 kW, modulating (PVs generate excess in summer; buy back in winter)	Electric fan coil down stream of hydronic fan coil (PVs generate excess in summer; buy back in winter) expected useage ~800 kWh/year	Trinity brand boiler, modulating (PVs generate excess in summer; buy back in winter; expected usage 15 - 20 days/year)	Thermolec elec. tankless boiler, 14 kW, modulating (PVs generate excess in summer; buy back in winter; expected usage 10 - 15 days/year)	Water-to-water heat pump; placeholder (not installed) for Thermotec elec. Boiler.
<b>Cooling</b>	Open windows @ night, close in morning; earthtubes deliver 65-75F air thru ERV, for daytime IAQ; skylight; Tamarack whole-house fan; Coolerado 1200 cfm/600W	2 Coolerado units	Open @ night, close in morning; skylight; QuietCool in bedrooms	Outdoor air supplied thru ductwork, to sub for opening windows; higher altitude, w/ cooler and more effective nighttime air	Outdoor air from earthtube supplied thru ductwork, + opening windows (motorized, programmed); higher altitude, w/ cooler and more effective nighttime air	1 Coolerado unit	ERV on EconoCool Mode
<b>Overhangs on south (2' projection, 12-16" above glazing)</b>	Yes	No	No	Yes on 80%	Yes	Yes	4' projection; some glazing will yield net loss over year
<b>\$ toward ZEH performance, for active solar (beyond envelope); % of building costs</b>	\$70,000; 8%	\$103,000; 7%	\$59,000; NA	\$93,000; 7%	\$68,000; 8%	\$60,000; 5%	\$224,000; 8%
<b>HERS Index Required</b>	Had it been built under the revised Green Points, would have been required to rate: 60	Had it been built under BuildSmart, would have been required to rate: less than 10	Not Required: 2009 GreenPoints does not address remodels	Not Required in Jefferson County	Not Required in Jefferson County	Less than 10	Not Required in Grand County
<b>HERS Index Rated From Plans OR "Confirmed" (at first occupancy)</b>	EnergyStar 97.7 (Converted to post-2006 metric = HERS Index -3 confirmed)	19 confirmed	Not rated	15 confirmed	-3 confirmed	9 rated	Not yet rated; ~ -10
<b>Projected Actual HERS Performance</b>	-10 verified	25	5	20	Year 1 data logging in progress	likely 0	~0 w/EV charging