2009 MONTANA BUILDING CODE PROJECT

PROPOSED MONTANA ENERGY AMENDMENTS TO THE 2009 IECC

ANALYSIS AND REPORT PREPARED BY:

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SUPPORTED BY:

The Policy Institute, AERO, MEIC, NCAT, Citizens for Clean Energy, NW Energy Coalition
Lincoln Electric Cooperative, Ravalli Electric Cooperative
Carpenters Local Union 28, Missoula, Missoula Area Central Labor Council, AFL-CIO
Energetechs, Kinkeye Limited Farm Corporation, Liquid Solar Systems, Littlefoot Building, Sage Mountain Center, Sustainable Building Center,
Sustainable Obtainable Solutions, Yes, Solar Solutions of Yellowstone.

INDEX:

INTRODUCTION:

The following are proposed amendments to the 2009 IECC for the State of Montana. This study grew out of the November 2008 meeting in Helena hosted by Dave Cook of the Building Codes Division, Montana Department of Labor & Industry. The consensus at that meeting, attended by a cross section of Montana contractors, building code officials and energy/environmental groups, was to adopt the 2009 IECC. A discussion was also held that some portions of the proposed energy code had changed little in the past 30 years and that a further look at those measures was warranted. Improving the Energy Code would have a broad effect across the state and have long term benefits both for homeowners and society as a whole.

Our goal in this analysis has been to identify the measures that would most effectively improve the energy performance of new houses built in Montana. Our process was to identify those provisions in the 2009 code that were weakest from an energy standpoint and then propose alternative standards that are relatively in-expensive, require modest changes in the field and offer significant pay-backs.

Using the *Energy Gauge* software program, we analyzed a standardized 1600 square foot house in a Montana climate, and used current energy prices to calculate annual energy savings. We looked at over a dozen changes to the insulation package on this base house.

We also solicited building cost estimates from a variety of experienced builders, and from suppliers and sub contractors for each of those changes. By comparing annual energy savings to the additional costs (or savings) of construction, we were able to calculate the costs and benefits of each option. Out of this analysis we selected six measures that were most cost effective.

Our recommendations were also informed by other factors. As a long-time builder, my goal was to make these changes as easy as possible on the building community. Material cost, training of crews, and access to new materials were considered. We also looked at the needs of homeowners and at the long term effects of these changes on buildings. As a result, we factored in the need for indoor air quality, prevention of moisture & mold buildup and at "opportunity costs" to finalize our recommendations. As shown in the analysis, our recommended package is moderate.

Although the changes proposed are modest and result in a very small additional cost to the builder and homeowner, the energy and economic benefits resulting from the whole package of proposed amendments are significant. The first year return on investment (R.O.I.) is calculated at over 8% and the annual savings to the homeowner would be about $335. If the additional costs (1-2% of construction costs) of these measures are financed through a mortgage, then a positive cash flow begins in the first year. Available Tax Credits significantly improve these figures. These savings directly benefit families by making home-ownership more affordable and should help homebuilders market more buildings. We therefore recommend that *all* of these measures be adopted as a package.

PROPOSED MONTANA AMEMDMENTS
TO THE 2009 IECC

PROPOSED CHANGE #1: Increase the R-value of wood frame walls from R-20 to R-25.

DESCRIPTION: Change R-value for wood frame walls on Table 402.1.1 from "20 or 13+5g" to "25 or 20+5g." in Climate Zone 6.

JUSTIFICATION: R-19/20 insulation standards for walls have been in place for 30 years in Montana but are no longer appropriate given the current and projected cost of energy and the national/international concern over energy resources and global warming. Numerous systems for achieving R-25 have been field tested and are known to the building community. Those systems include R-5 insulation sheathing over 2x6 framing, SIPS panels, 2x8 plates with staggered stud framing, and various spray foam/batt insulation combinations. We included several wall types in our energy analysis to study the range of performance and savings.

COST SAVINGS ANALYSIS: We surveyed experienced builders in Montana who have used a variety of wall systems. Additional construction costs, as applied to our "Base House," ranged from $903 for R-5 sheathing over studs, to $5,590 for SIPS panels. Most estimates were under $2,000. It should be noted that the SIPS panels, though more expensive, offer continuous insulation without the thermal bridging of a framed wall system and result in increased control of air infiltration. Energy savings ranged from $40 to $200 per year with a first year R.O.I. of 3.5 to 5%. Even though the payback for this measure was moderately long, we advocate this amendment to lock in the "opportunity costs" of these measures. It is much easier to build in these measures at the time of construction rather than at a later date should energy costs rise dramatically.

PROPOSED CHANGE #2: Require R-49 insulation in all ceilings without attic spaces..

DESCRIPTION: In 402.2, delete section 402.2.2, which allows 500 sqft of R-30 insulation in ceilings without attic spaces.

JUSTIFICATION: The current code allows lower insulation levels for 500 sqft of sloped ceilings. R-30 roofs lose significantly more energy than R-48 ceilings. High levels of insulation are appropriate because warm air often stratifies adjacent to ceilings. Thermal bridging through the framing is also a major source of heat loss. The use of deeper ceiling rafters, of rafter trusses, or of spray foam insulation can achieve the recommended insulation levels in those areas. Because stick framed roofs and dormers are difficult to energy retrofit, the "opportunity costs" of this measure are significant.

COST SAVINGS ANALYSIS: According to our computer runs, an R-30 ceiling increases overall annual heat loss by 10%. Increasing cathedral ceiling insulation from

R-30 to R-48 would reduce that amount and save about $20 per year in heating costs. Construction costs averaged about $400 and the ROI was over 5%.

PROPOSED CHANGE #3: Eliminate the current Montana Amendment that allows un-occupied basements to remain un-insulated until the space is occupied.

DESCRIPTION: Strike out the relevant clauses from the Montana Amendments to the 2003 IECC.

JUSTIFICATION: Most new houses in Montana are built over a basement. If a basement remains un-insulated after a residence is occupied, significant amount of heat from the conditioned space is lost through the floor into the basement and then out of the structure. Concrete is an extremely poor material for resisting heat flow. Because most basements contain heating and plumbing equipment and are eventually finished, we propose that the exterior walls be insulated to R-19. The most typical method would be 2x4 studs, batt insulation and a fire retardant vapor barrier. It is relatively easy and inexpensive, when finishing the space at a later date, to add wiring and drywall.

COST SAVINGS ANALYSIS: This is one of the most cost-effective measures proposed. Our study found a $290 per year energy savings and a 12.9% ROI with this measure if the space remains unconditioned. If the insulated space is to be occupied and heated, then energy expenses would increase while the amount of living space would double.

PROPOSED CHANGE #4: Decrease the U-value in windows from U-.35 to U-.32. Windows on the South side of the house (within 20% of true South) to have a maximum U-value of .48 and a minimum SHGC of .55.

DESCRIPTION: Change the U-value for Fenestration on Table 402.1.1 in the 2009 IECC from .35 to .32. Windows facing within 20% of due South may have a maximum U-value of .48 and a minimum SHGC of .55 if the total south glass area is under 8% of total floor area,

JUSTIFICATION: Current windows that are rated at U-.35 are typically double glazed insulated glass with one Low-E coating. The decrease in U-value to .32 can be achieved by using alternative frame & sash materials, changing the type of Low-E coating or by adding Argon gas to the insulated glass cavity. About half of the major window manufacturers now offer one of these options in Montana. It is anticipated that the other window companies will quickly follow suit. The increased cost of this change ranged from $0 to $230 for the entire house.

Double glazed southern windows can contribute significantly to the heating of the building by absorbing solar energy. They are also cheaper than Low-E windows. Over-sizing of the southern windows, however, can result in significant overheating of the living area in some periods of the year.

COST SAVINGS ANALYSIS: In our survey, we found that total cost of a tuned window package was equal or very close to the cost of windows in the Base House, $52 on average. The less expensive southern windows offset the additional cost of lower U-values on the windows on the East, North and West sides of the building. The energy performance of this combination was also much better, saving more money the first year than the average additional cost. Depending on the brand of windows purchased, the payback period averaged less than one year!

PROPOSED CHANGE #5: Increase the prescriptive specifications for building sealing and reduce the allowable tested air infiltration rate from 7 ACH50 to 4ACH50.

DESCRIPTION: In 402.4.1, add the following details:
#1 All joints, seams and penetrations: *add* <u>including under bottom plates</u>. *Add* <u>All framing cavities to be blocked where framing planes intersect</u>.
#4. Utility penetrations: *add* <u>including wiring, plumbing and ductwork at top and bottom plates, studs and exterior sheathing</u>. <u>Lighting boxes in ceiling lids to be sealed at the wire/box junction and at the box/GWB joint</u>.
#11. Rim joist junction: *add* <u>at the sillplate/foundation, rim/sillplate and rim/subfloor junctions</u>.

Change the tested air leakage in 402.4.2.1 from 7 to 4ACH.

JUSTIFICATION: Air leakage is difficult to control, but contributes significantly to the heat load of buildings. Leaky buildings are colder and draftier in windy periods. Air leaks are also the source of frequent moisture problems within building cavities. We propose to specify tighter construction practices in known problem areas. Increased air leakage control should result in higher occupant satisfaction, sounder building practices and lessened contractor liability issues.

COST SAVINGS ANALYSIS: Our analysis shows that reducing air infiltration from 7 to 4 ACH50 will save a significant amount of energy and, because of the low cost associated with these measures, could result in a 20% ROI.

PROPOSED CHANGE #6: Add a mechanical ventilation standard for Montana residences. Generally, 100 cfm, low-sone exhaust fans in kitchens and 50 cfm fans in bathrooms would be required. Air intake vents would also be required. Fan controls would be by timer or humidistat.

DESCRIPTION: Section 403.5.1: All newly constructed Montana residences shall comply with ASHRAE 62.2

JUSTIFICATION: Changing building practices, materials and efforts at energy conservation since the late 1970's have resulted in a general tightening of building shells. That trend is expected to continue as jurisdictions respond to energy and global warming issues. Tighter houses however, have resulted in problems associated with indoor air

quality, increased health problems, moisture damage and perceived poor air quality by occupants.

Rather than rely on variable and unknown air flows through buildings, ASHRAE 62.2 specifies the minimum level of ventilation required for occupant health, safety and building protection. These requirements are quite simple and have been readily adopted in other neighboring states. Control of exhaust fans is by the occupant, relieving the builder of liability issues.

COST SAVINGS ANALYSIS: Mechanical Ventilation adds several hundred dollars to the construction costs of a building project. Operating costs are also increased depending on the size and operating schedule of the fans. Those costs can be balanced against the savings from air infiltration control and also justified on other practical grounds.

2009 Montana Energy Code Project

Base House Detail

Size:

1600 sqft, 32'x50', 164 lft perimeter, 8 ft ceilings, single floor, unfinished & un-insulated basement. 8/12 roof w/ 2 foot overhang.

3 bedroom, 2 bath

Windows:

South: 72 sqft windows,
West: 24 sqft windows
North: 72 sqft windows,
East: 24 sqft windows.
Total windows: 192 sqft, 12% of floor area.

Insulation:

Walls: R-20
Attic: R-38 at Exterior Walls, R-49 in the field
Cathedral Ceilings: R-30
Basement: Non-required per 2003 MT Amendments if un-conditioned space.
Windows: U=. 35, clad wood casements.
Doors: North door, 20-sqft metal insulated w/ thermal break, half lite glass.
South door; 20-sqft wood door w/ half lite glass.

Air leakage/ventilation:

Per 2009 code, caulking & sealing per 402.5.1 or,
Blower door test of 7ACH50

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Computer Analysis Description:

1. Computer runs are for annual heating and ventilating loads. Appliance, equipment and lighting loads are standardized and not included in this analysis.

2. Input data for the **Base #1 and for Base House #1 Tot-A** are included as addendum. Output for all three house packages are included for comparison.

3. All computer runs are compared to **Base #1,** except for **Base #1 Cath'l 48** which is compared against **Base Cath'l.**

4. Construction Costs reflect the additional costs above the **Base House #1.** Costs are provisional, based on an ongoing survey of 10 experienced energy builders across Montana, window distributors and insulation sub-contractors. An attempt was made to use costs that were reasonable, but that reflected experienced crews. Cost included 14% O&P.

5. Return on Investment (R.O.I. Year 1) was calculated by dividing Construction Costs by 1st year Energy Savings.

6. Payback Years and 20 Year Energy Savings based on 5% energy inflation.

Energy Savings and Construction Cost Summary:

Computer Runs:

1. **Base #1:** The "Base House", see attached sheet for details.
2. **Base #1 Cath'l:** includes 500 square feet of R-30 cathedral ceiling. Included are heat loss and construction costs of associated gable walls.
3. **Base #1 Wa** reflects least expensive method of 7 wall types studied. Energy savings are not optimal.
4. **Base #1 Wa-AdvFrm:** reflects a more effective R-25 wall types: 2x8 plates, 2x4 staggered studs, advanced framing techniques and batt insulation.
5. **Base #1 Wa-SIPS:** reflects R-24 SIPS panels and includes a reduction of air infiltration to 4ACH50.
6. **Base #1 R-Heel:** reflects using raised heel trusses instead of standard trusses and achieving R-49 continuous to the outside of the plates. Costs include the extra cost of the trusses as well as additional sheathing and siding.
7. **Base #1 Cath'l 48:** reflects the least cost alternative of 5 roof systems studied. 14 inch TJI rafters and batt insulation.

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8. **Base #1 BaUnCond:** reflects the cost of 2x4 framed perimeter walls, R-19 batt insulation and Vapor Barrier in the basement. The space is unconditioned.
9. **Base #1 BaCond:** reflects the cost of 2x4 framed perimeter walls, R-19 batt insulation and Vapor Barrier in the basement. No finish materials were included. No basement windows were included in the costs or energy analysis. Higher energy load reflects larger volume of conditioned space.
10. **Base #1 Wi:** Decreases the U-value of all windows from U-35 to U-32 with the addition of argon gas. Breather tube improvements by Cardinal Glass now allow use of argon in higher elevations. About half of the major window manufacturers have adopted this method.
11. **Base #1 WiT:** Tuned windows. U-.32 on N, E & W windows, U-.47 on South. North windows reduced to 56 sqft., South windows increased to 88 sqft.
12. **Base #1 Inf4:** Reduce code allowable air change from 7 ACH50 to 4ACH50.
13. **Base #1 Inf4/Vent:** Air infiltration reduced to 4ACH50, Additional mechanical ventilation per ASHRAE 2.2.
14. **Base #1 Inf2/Vent:** Air infiltration reduced to 2ACH50, Additional mechanical ventilation per ASHRAE 2.2.
15. **Base #1 WiT2:** Tuned, high performance windows. U-.20 on N, E & W windows, U-.47 on South. North windows reduced to 56 sqft., South windows increased to 88 sqft.
16. **Base #1 Inf2/HRV:** Air infiltration reduced to 2ACH50. Mechanical ventilation by HRV.
17. **Base #1 Inf1/HRV:** Air infiltration reduced to 1ACH50. Mechanical ventilation by HRV.

Whole House Totals:

1. **Base House #1 Tot-A**: This is the base house with the recommended Mt. Amendments to the 2009 IECC. Whole house analysis containing energy improvements #'s 3, 8, 11, & 13 above. Energy savings & construction costs are compared to **Base House #1.**
2. **Base House #1 Tot-B:** Whole house analysis containing energy improvements #'s 3, 8, 11, & 14. Energy savings & construction costs are compared to **Base House #1.**
3. **Base House #1 Tot-C:** Whole house analysis containing energy improvements #'s 3, 8, 15, & 17. Energy savings & construction costs are compared to **Base House #1.**

Economic Summary Description:

1. Four scenarios are presented; the first, **Base #1 Tot-A House,** is for the base house with proposed Montana amendments and no tax credits. The final three are for **Tot-A, B & C** with the tax credits.

2. Energy savings and construction costs are from the Energy Savings and Construction Costs Summary.

3. Figures for Tax Credits are based on current national and state code and do not reflect future proposed code increases. Use of these credits assumes that all National code requirements, such as high efficient appliances and equipment are met. Use of these credits also assumes that builder tax credits are passed on to homeowners.

4. Add'l Mortgage costs based on 30 year fixed loan @ 5% interest.

5. Mortgage Tax Credit based on 20% marginal tax rate.

6. Net 1st Year Savings/Loss assumes that additional construction costs are added to the mortgage.

7. 1st Year ROI divides Total Energy Savings by the Net Construction Cost.

8. Payback in Years is based on when Net Savings (w/ 5% energy inflation) will pay back Net Construction Costs.

9. 20 Year Energy Savings based on 5% annual energy inflation.

10. 20 Year Total Savings is Energy Savings less Cumulative Mortgage Costs. See Cash Flow Summary.

Conclusions:

1. In all cases, energy savings create a positive cash flow from the first year. Return On Investment, in all cases studied, is far above current market rates.

2. Tax credits have a notable impact on 1st year cash flow.

3. Larger investments in energy efficiency measures yield lower first year ROI but significantly larger savings over time.

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2009 Montana Energy Code Amendments

Energy Savings and Construction Cost Summary

Runs	Inc. in Tot.	Measure	Annual therm	Annual kWh	Therm savings	kWh Saving	Annual E-Cost	Tot E Saving	Const. Cost	R.O.I. Year 1	Payback Years	20 Year E Savings
Base House #1												
1		*Base #1*	*1154.0*	*6151.0*	*0.0*	*0.0*	*$1,978.00*	*$0.00*	*$0.00*			*$0.00*
2		*Base #1Cath'l*	*1303.0*	*6254.0*	*149.0*	*103.0*	*$2,162.00*	*$184.00*	*$923.00*			*$6,084.00*
Possible MT Code Amendments:												
3	A,B,C	Base #1Wa	1118.0	6127.0	36.0	24.0	$1,933.00	$45.00	$903.00	5.0%	14.2	$1,488.00
4		Base #1Wa-AdvFm	1092.0	6109.0	62.0	42.0	$1,901.00	$77.00	$1,775.00	4.3%	16.7	$2,546.00
5		Base #1 Wa-SIPS	998.0	6047.0	156.0	104.0	$1,784.00	$194.00	$5,588.00	3.5%	18.2	$6,415.00
6		Base #1 R-Heel	1141.0	6149.0	13.0	2.0	$1,963.00	$15.00	$800.00	1.9%	26.7	$496.00
7		Base #1Cath'l 48	1286.0	6241.0	17.0	13.0	$2,141.00	$21.00	$400.00	5.3%	13.7	$694.00
8	A,B,C	Base #1BaUnCond	917.0	6011.0	237.0	140.0	$1,687.00	$291.00	$2,280.00	12.8%	6.3	$9,622.00
9		Base #1BaCond	1158.0	6203.0	4.0	52.0	$1,988.00	$10.00	$2,280.00	-0.4%		
10		Base #1Wi	1139.0	6141.0	15.0	10.0	$1,959.00	$19.00	$226.00	8.4%	9.5	$628.00
11	A, B	Base #1WiT	1102.0	6117.0	52.0	34.0	$1,914.00	$64.00	$52.00	123.1%	0.8	$2,116.00
12		Base #1Inf4	1051.0	6082.0	103.0	69.0	$1,850.00	$128.00	$630.00	20.3%	4.6	$4,232.00
13	A	Base #1Inf4/Vent	1159.0	6328.0	5.0	177.0	$2,002.00	$24.00	$880.00	-2.7%		
Base House #1Tot-A			867.0	6150.0	287.0	1.0	$1,642.00	$336.00	$4,115.00	8.2%	9.7	$11,110.00
	Additional Measures:											
14	B	Base #1Inf2/Vent	1126.0	6309.0	28.0	158.0	$1,962.00	$16.00	$1,255.00	1.3%	30+	$529.00
Base House #1Tot-B			796.0	6100.0	507.0	51.0	$1,554.00	$424.00	$5,290.00	8.0%	9.8	$14,020.00
	High Performance Measures:											
15	**C**	Base #1WiT2	1064.0	6093.0	90.0	58.0	$1,867.00	$111.00	$723.00	15.4%	5.8	$3,670.00
16		Base #1Inf2/HRV	1001.0	6372.0	153.0	-221.0	$1,822.00	$156.00	$3,200.00	4.9%	14.5	$5,158.00
17	**C**	Base #1Inf1/HRV	968.0	6348.0	186.0	-197.0	$1,780.00	$198.00	$3,700.00	5.4%	13.5	$6,547.00
Base House #1Tot-C			597.0	5958.0	706.0	296.0	$1,307.00	$671.00	$9,278.00	7.2%	10.7	$22,187.00

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2009 Montana Energy Code Amendments

Economic Summary

Base #1Tot-A House:				**Base #1Tot-A House w/ Tax Credits:**			
Total Add'l Const. Cost:		$4,115.00		**Total C. Cost:**		$4,115.00	
Fed. Tax Credit 2008		$0.00		**Fed. Tax Credit 2009**		$2,000.00	
MT Tax Credit 2008:		$0.00		**MT Tax Credit 2009:**		$1,000.00	
NW Energy Rebate:		$0.00		**NW Energy Rebate:**		$0.00	
Net Const. Cost:		$4,115.00		**Net Const. Cost:**		$1,115.00	
Total E Savings		$336.00	/yr.	**Total E Savings**		$336.00	/yr.
Add'l Mortgage:	**25.00**	-$300.00	/yr.	**Add'l Mortgage:**	**9.00**	-$108.00	/yr.
Mortgage Tax Cr.		$60.00		**Mortgage Tax Cr.**		$21.60	
Net 1st Year Savings/Loss:		$96.00	/yr.	**Net 1st Savings/Loss:**		$249.60	/yr.
1st Year ROI:		2.3%		**1st Year ROI:**		22.4%	
Payback in Years:		16.2	yrs	**Payback:**		4.2	yrs.
20 Yr E. Savings:		$11,110.00		**20 Yr E. Savings:**		$11,110.00	
20 Yr Net Savings:		$6,310.16		**20 Yr Net Savings:**		$9,382.16	
Base #1Tot-B House w/ Tax Cı				**Base #1Tot-C House w/ Tax C**			
Total Add'l Const. Cost:		$5,290.00		**Total Add'l Const. Cost:**		$9,278.00	
Fed. Tax Credit 2009		$2,000.00		**Fed. Tax Credit 2009:**		$2,000.00	
MT Tax Credit 2009:		$1,000.00		**MT Tax Credit 2009:**		$1,000.00	
NW Energy Rebate:		$0.00		**NW Energy Rebate:**		$0.00	
Net Const. Cost:		$2,258.80		**Net Const. Cost:**		$6,198.20	
Total E Savings		$424.00	/yr.	**Total E Savings**		$671.00	/yr.
Add'l Mortgage:	**13.00**	-$156.00	/yr.	**Add'l Mortgage:**	**33.25**	-$399.00	/yr.
Mortgage Tax Cr.		$31.20		**Mortgage Tax Cr.**		$79.80	
Net 1st YearSavings/Loss:		$299.20	/yr.	**Net Savings/Loss:**		$351.80	/yr.
1st Year ROI:		13.2%		**1st Year ROI:**		5.7%	
Payback in Years:		6.5	yrs	**Payback:**		11.2	yrs
20 Yr E. Savings:		$14,020.00		**20 Yr E. Savings:**		$22,187.26	
20 Yr Net Savings:		$11,523.96		**20 Yr Net Savings:**		$15,803.26	

Assumptions:

1 Assumes add'l Energy Measures to meet Fed. Code: e.g. appliances, equipment
2 Assume $2000 Builder Tax Credit passed to Owner
3 Assume 5% 30 yr fixed mortgage.
4 Assume 20% Fed Tax Bracket
5 Assume 5% Fuel Inflation Rate.

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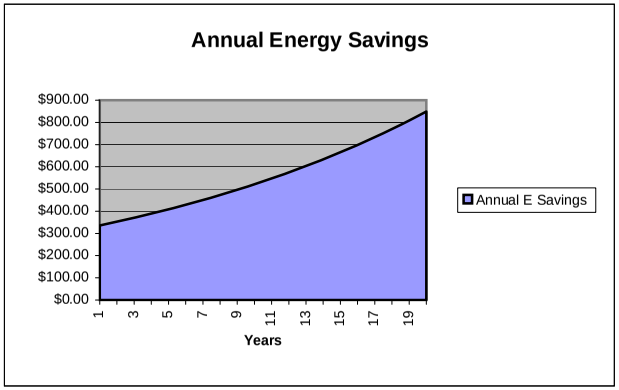
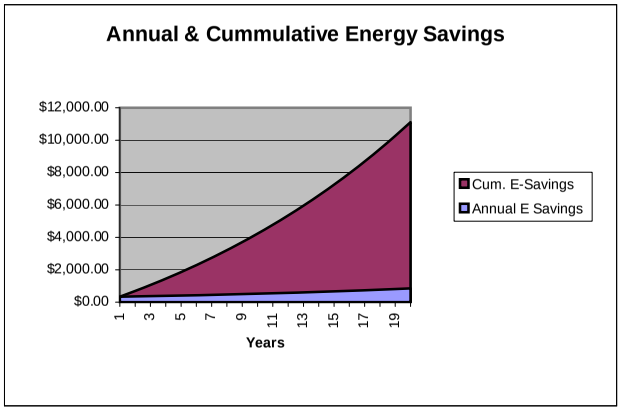
CASH FLOW SUMMARY

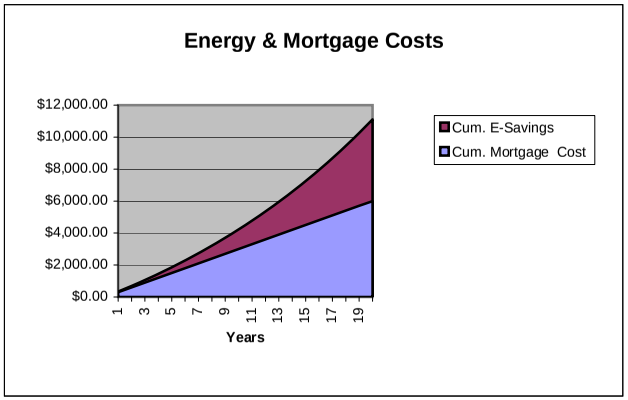
Base House #1Tot-A w/o Tax Credits

Energy rate of Inflation: 105%

Year	Annual E Savings	Cum. E-Savings	Const. Cost	R.O.I.	Cum. Mortgage Cost	Cum Mort.T Credit	Cum. Net Savings
1	$336.00	$336.00	$4,115.00	-91.8%	$300.00	$60.00	$96.00
2	$352.80	$688.80		-83.3%	$600.00	$120.00	$208.80
3	$370.44	$1,059.24		-74.3%	$900.00	$180.00	$339.24
4	$388.96	$1,448.20		-64.8%	$1,200.00	$240.00	$488.20
5	$408.41	$1,856.61		-54.9%	$1,500.00	$300.00	$656.61
6	$428.83	$2,285.44		-44.5%	$1,800.00	$360.00	$845.44
7	$450.27	$2,735.71		-33.5%	$2,100.00	$420.00	$1,055.71
8	$472.79	$3,208.50		-22.0%	$2,400.00	$480.00	$1,288.50
9	$496.43	$3,704.93		-10.0%	$2,700.00	$540.00	$1,544.93
10	$521.25	$4,226.17		2.7%	$3,000.00	$600.00	$1,826.17
11	$547.31	$4,773.48		16.0%	$3,300.00	$660.00	$2,133.48
12	$574.67	$5,348.15		30.0%	$3,600.00	$720.00	$2,468.15
13	$603.41	$5,951.56		44.6%	$3,900.00	$780.00	$2,831.56
14	$633.58	$6,585.14		60.0%	$4,200.00	$840.00	$3,225.14
15	$665.26	$7,250.40		76.2%	$4,500.00	$900.00	$3,650.40
16	$698.52	$7,948.92		93.2%	$4,800.00	$960.00	$4,108.92
17	$733.45	$8,682.36		111.0%	$5,100.00	$1,020.00	$4,602.36
18	$770.12	$9,452.48		129.7%	$5,400.00	$1,080.00	$5,132.48
19	$808.62	$10,261.11		149.4%	$5,700.00	$1,140.00	$5,701.11
20	$849.06	$11,110.16		170.0%	$6,000.00	$1,200.00	$6,310.16







Montana Energy+Design
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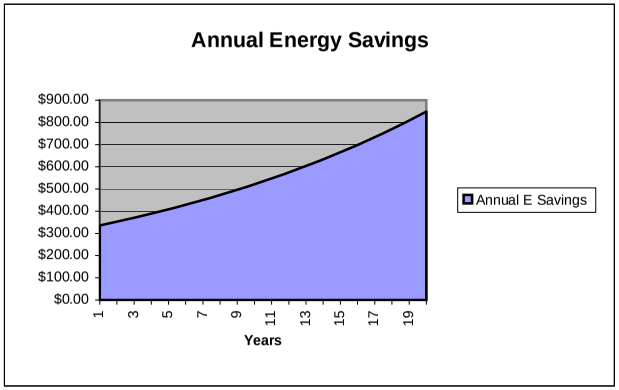
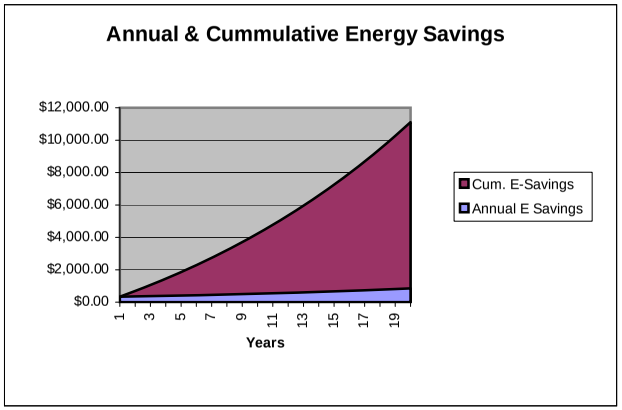
CASH FLOW SUMMARY

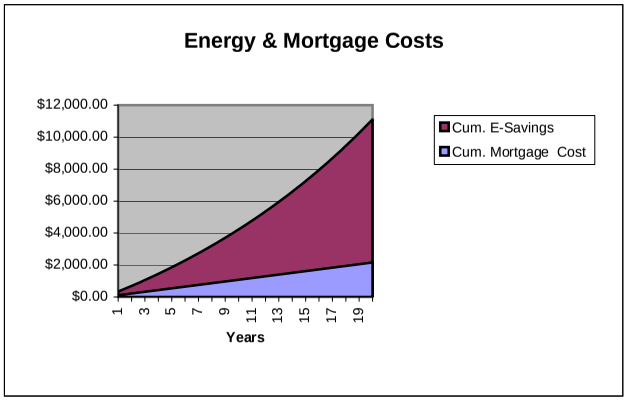
Base House #1Tot-A w/ Tax Credits

Energy rate of Inflation: 105%

Year	Annual E Savings	Cum. E-Savings	Const. Cost	R.O.I.	Cum. Mortgage Cost	Cum Mort.T Credit	Cum. Net Savings
1	$336.00	$336.00	$1,115.00	-69.9%	$108.00	$21.60	$249.60
2	$352.80	$688.80		-38.2%	$216.00	$43.20	$516.00
3	$370.44	$1,059.24		-5.0%	$324.00	$64.80	$800.04
4	$388.96	$1,448.20		29.9%	$432.00	$86.40	$1,102.60
5	$408.41	$1,856.61		66.5%	$540.00	$108.00	$1,424.61
6	$428.83	$2,285.44		105.0%	$648.00	$129.60	$1,767.04
7	$450.27	$2,735.71		145.4%	$756.00	$151.20	$2,130.91
8	$472.79	$3,208.50		187.8%	$864.00	$172.80	$2,517.30
9	$496.43	$3,704.93		232.3%	$972.00	$194.40	$2,927.33
10	$521.25	$4,226.17		279.0%	$1,080.00	$216.00	$3,362.17
11	$547.31	$4,773.48		328.1%	$1,188.00	$237.60	$3,823.08
12	$574.67	$5,348.15		379.7%	$1,296.00	$259.20	$4,311.35
13	$603.41	$5,951.56		433.8%	$1,404.00	$280.80	$4,828.36
14	$633.58	$6,585.14		490.6%	$1,512.00	$302.40	$5,375.54
15	$665.26	$7,250.40		550.3%	$1,620.00	$324.00	$5,954.40
16	$698.52	$7,948.92		612.9%	$1,728.00	$345.60	$6,566.52
17	$733.45	$8,682.36		678.7%	$1,836.00	$367.20	$7,213.56
18	$770.12	$9,452.48		747.8%	$1,944.00	$388.80	$7,897.28
19	$808.62	$10,261.11		820.3%	$2,052.00	$410.40	$8,619.51
20	$849.06	$11,110.16		896.4%	$2,160.00	$432.00	$9,382.16







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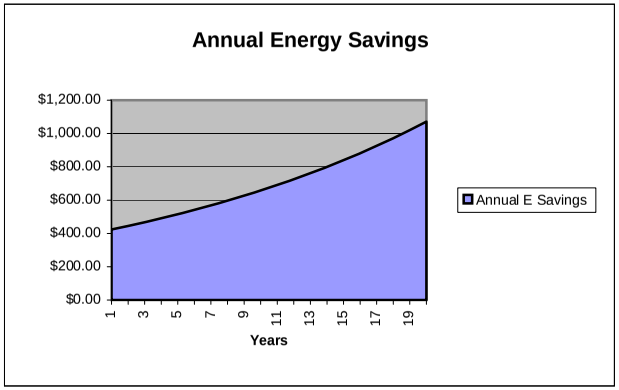
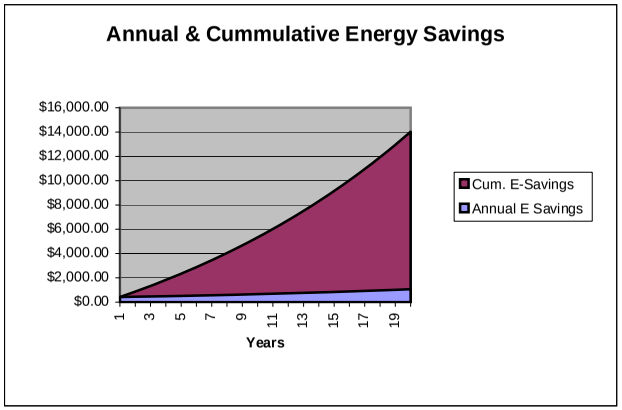
CASH FLOW SUMMARY

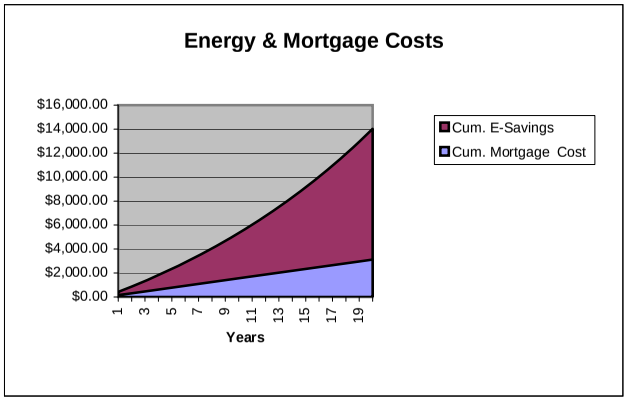
Base House #1Tot-B w/ Tax Credits

Energy rate of Inflation: 105%

Year	Annual E Savings	Cum. E-Savings	Const. Cost	R.O.I.	Cum. Mortgage Cost	Cum Mort.T Credit	Cum. Net Savings
1	$424.00	$424.00	$2,259.00	-81.2%	$156.00	$31.20	$299.20
2	$445.20	$869.20		-61.5%	$312.00	$62.40	$619.60
3	$467.46	$1,336.66		-40.8%	$468.00	$93.60	$962.26
4	$490.83	$1,827.49		-19.1%	$624.00	$124.80	$1,328.29
5	$515.37	$2,342.87		3.7%	$780.00	$156.00	$1,718.87
6	$541.14	$2,884.01		27.7%	$936.00	$187.20	$2,135.21
7	$568.20	$3,452.21		52.8%	$1,092.00	$218.40	$2,578.61
8	$596.61	$4,048.82		79.2%	$1,248.00	$249.60	$3,050.42
9	$626.44	$4,675.26		107.0%	$1,404.00	$280.80	$3,552.06
10	$657.76	$5,333.03		136.1%	$1,560.00	$312.00	$4,085.03
11	$690.65	$6,023.68		166.7%	$1,716.00	$343.20	$4,650.88
12	$725.18	$6,748.86		198.8%	$1,872.00	$374.40	$5,251.26
13	$761.44	$7,510.30		232.5%	$2,028.00	$405.60	$5,887.90
14	$799.52	$8,309.82		267.9%	$2,184.00	$436.80	$6,562.62
15	$839.49	$9,149.31		305.0%	$2,340.00	$468.00	$7,277.31
16	$881.47	$10,030.78		344.0%	$2,496.00	$499.20	$8,033.98
17	$925.54	$10,956.32		385.0%	$2,652.00	$530.40	$8,834.72
18	$971.82	$11,928.13		428.0%	$2,808.00	$561.60	$9,681.73
19	$1,020.41	$12,948.54		473.2%	$2,964.00	$592.80	$10,577.34
20	$1,071.43	$14,019.96		520.6%	$3,120.00	$624.00	$11,523.96







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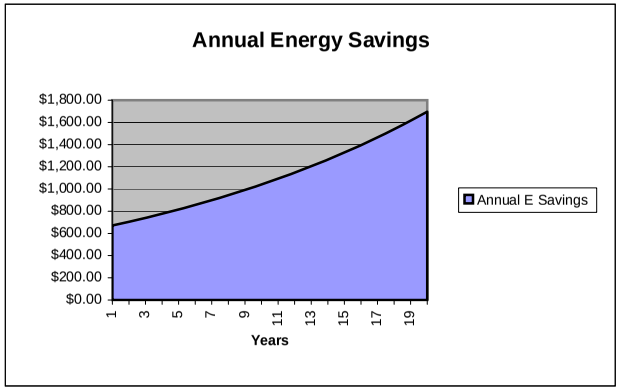
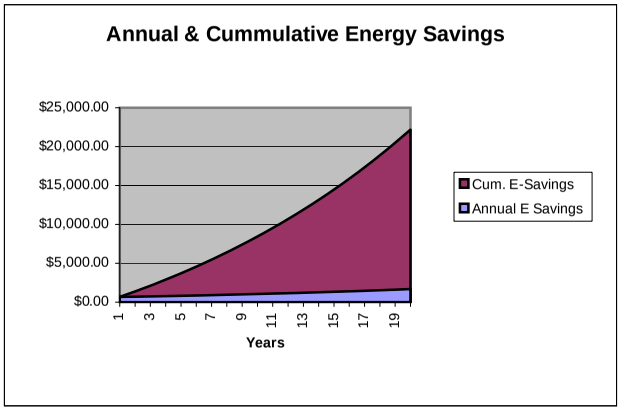
CASH FLOW SUMMARY

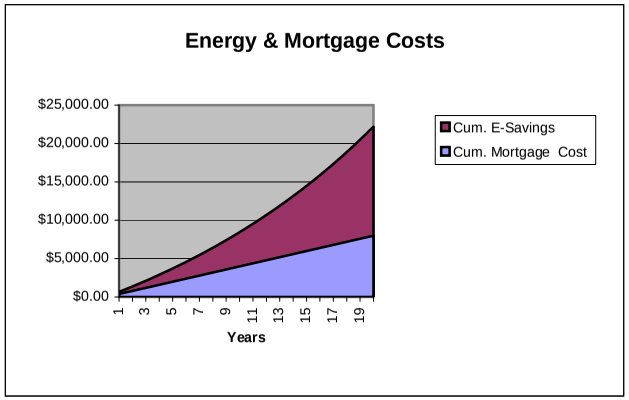
Base House #1Tot-C w/ Tax Credits

Energy rate of Inflation: 105%

Year	Annual E Savings	Cum. E-Savings	Const. Cost	R.O.I.	Cum. Mortgage Cost	Cum Mort.T Credit	Cum. Net Savings
1	$671.00	$671.00	$6,198.20	-89.2%	$399.00	$79.80	$351.80
2	$704.55	$1,375.55		-77.8%	$798.00	$159.60	$737.15
3	$739.78	$2,115.33		-65.9%	$1,197.00	$239.40	$1,157.73
4	$776.77	$2,892.09		-53.3%	$1,596.00	$319.20	$1,615.29
5	$815.60	$3,707.70		-40.2%	$1,995.00	$399.00	$2,111.70
6	$856.38	$4,564.08		-26.4%	$2,394.00	$478.80	$2,648.88
7	$899.20	$5,463.29		-11.9%	$2,793.00	$558.60	$3,228.89
8	$944.16	$6,407.45		3.4%	$3,192.00	$638.40	$3,853.85
9	$991.37	$7,398.82		19.4%	$3,591.00	$718.20	$4,526.02
10	$1,040.94	$8,439.77		36.2%	$3,990.00	$798.00	$5,247.77
11	$1,092.99	$9,532.75		53.8%	$4,389.00	$877.80	$6,021.55
12	$1,147.64	$10,680.39		72.3%	$4,788.00	$957.60	$6,849.99
13	$1,205.02	$11,885.41		91.8%	$5,187.00	$1,037.40	$7,735.81
14	$1,265.27	$13,150.68		112.2%	$5,586.00	$1,117.20	$8,681.88
15	$1,328.53	$14,479.22		133.6%	$5,985.00	$1,197.00	$9,691.22
16	$1,394.96	$15,874.18		156.1%	$6,384.00	$1,276.80	$10,766.98
17	$1,464.71	$17,338.89		179.7%	$6,783.00	$1,356.60	$11,912.49
18	$1,537.94	$18,876.83		204.6%	$7,182.00	$1,436.40	$13,131.23
19	$1,614.84	$20,491.67		230.6%	$7,581.00	$1,516.20	$14,426.87
20	$1,695.58	$22,187.26		258.0%	$7,980.00	$1,596.00	$15,803.26







Building Input Comparison Report

PROJECT

Title:	Energy Code - Base #1	New/Existing:	New (From Pl	Title:	Energy Code - Base #1	New/Existing:	New (From Pl
Building Type:	User	Bedrooms:	3	Building Type:	User	Bedrooms:	3
Owner:	Mt Energy+Design	Bathrooms:	2	Owner:	Mt Energy+Design	Bathrooms:	2
# of Units:	1	Conditioned Area:	1600 ft²	# of Units:	1	Conditioned Area:	1600 ft²
Builder Name:		Total Stories:	1	Builder Name:		Total Stories:	1
Climate:		Worst Case:	No	Climate:		Worst Case:	No
Permit Office:		Rotate Angle:	0	Permit Office:		Rotate Angle:	0
Jurisdiction:	Montana	Cross Ventilation:		Jurisdiction:	Montana	Cross Ventilation:	
Family Type:	Single-family	Whole House Fan:		Family Type:	Single-family	Whole House Fan:	
Adress:	NA			Adress:	NA		
	Great Falls , Mt , 59401-				Great Falls , Mt , 59401-		
Comment:	MEC-2009 IEEC - Base house			Comment:	MEC-2009 IEEC - Base house - Tot-A		

CLIMATE

TMY Site:	MT_GREATFALLS			TMY Site:	MT_GREATFALLS		
Design Location:	MT, Great Falls			Design Location:	MT, Great Falls		
Design Temp (2.5%):	88	Heating Degree Days:	7652	Design Temp (2.5%):	88	Heating Degree Days:	7652
Design Temp (97.5%):	-15	Design Moisture:	0	Design Temp (97.5%):	-15	Design Moisture:	0
Int Design Temp (Win):	70	Daily Temp Range:	High	Int Design Temp (Win):	70	Daily Temp Range:	High
Int Design Temp (Sum):	75			Int Design Temp (Sum):	75		

UTILITY RATES

Fuel	Unit	Utility Name	Fixed Cost	$/Unit
Electricity	kWh	NW Energy - Livingston	0	0.102
Natural Gas	Therm	NW Energy - Livingston	0	1.17
Fuel Oil	Gallon	Montana Default	0	1.1
Propane	Gallon	Montana Default	0	1.4

Fuel	Unit	Utility Name	Fixed Cost	$/Unit
Electricity	kWh	NW Energy - Livingston	0	0.102
Natural Gas	Therm	NW Energy - Livingston	0	1.17
Fuel Oil	Gallon	Montana Default	0	1.1
Propane	Gallon	Montana Default	0	1.4

SURROUNDINGS

Ornt	Shade Tree	Adjacent Building
N	No	No
NE	No	No
E	No	No
SE	No	No
S	No	No
SW	No	No
W	No	No
NW	No	No

Ornt	Shade Tree	Adjacent Building
N	No	No
NE	No	No
E	No	No
SE	No	No
S	No	No
SW	No	No
W	No	No
NW	No	No

FLOORS

#	Floor Type	Wall Peri	Wall Rval	Area	Ceil Rval
1	Basement Unfinished			1600 ft²	

#	Floor Type	Wall Peri	Wall Rval	Area	Ceil Rval
1	Basement Finished			1600 ft²	

ROOF

#	Materials	Attic Area	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1 in)
1	Compositionshingles	1600 ft²	0.85	N	0	300

#	Materials	Attic Area	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1 in)
1	Compositionshingles	1600 ft²	0.85	N	0	300

Building Input Comparison Report

CEILINGS

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	48	1436 ft²	0.11	Wood
2	Under Attic	38	164 ft²	0.11	Wood

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	48	1600 ft²	0.07	Wood

WALLS

Wall orientation below is as entered. Actual orientation is modified by rotate angle shown in "Project" section above.

#	Ornt	Adjacent To	Wall Type	R-Value	Area (ft²)	Frame Frac.	Solar Absor.
1	N	Exterior	Frame - Wood	19.00	408.3	0.23	0.75
2	E	Exterior	Frame - Wood	19.00	261.3	0.23	0.75
3	S	Exterior	Frame - Wood	19.00	408.3	0.23	0.75
4	W	Exterior	Frame - Wood	19.00	261.3	0.23	0.75

#	Ornt	Adjacent To	Wall Type	R-Value	Area (ft²)	Frame Fract.	Solar Absor.
1	N	Exterior	Frame - Wood	25.00	408.3	0.23	0.75
2	E	Exterior	Frame - Wood	25.00	261.3	0.23	0.75
3	S	Exterior	Frame - Wood	25.00	408.3	0.23	0.75
4	W	Exterior	Frame - Wood	25.00	261.3	0.23	0.75

DOORS

#	Ornt	Door Type	Storm	U-Value	Area
1		Insulated	Metal	0.2000	13.3
2		Wood	Wood	0.5400	10.0

#	Ornt	Door Type	Storm	U-Value	Area
1		Insulated	Metal	0.2000	13.3
2		Wood	Wood	0.5400	10.0

WINDOWS

Overall SHGC shown below is not directly input, but is calculated based on building type, window coverings and window properties

#	Ornt	Panes	U-Fac	Coef. Input Value	Type	Overall SHGC Win/Sum	Area (ft²)	OHD (ft)
1	N	D Low-E	0.35	0.30	SHGC	0.27/0.21	72.0	2.00
2	E	D Low-E	0.35	0.30	SHGC	0.27/0.21	24.0	2.00
3	S	D Low-E	0.35	0.30	SHGC	0.27/0.21	72.0	2.00
4	N	D Low-E	0.35	0.30	SHGC	0.27/0.21	24.0	2.00

#	Ornt	Panes	U-Fac	Coef. Input Value	Type	Overall SHGC Win/Sum	Area (ft²)	OHD (ft)
1	N	D Low-E	0.32	0.30	SHGC	0.27/0.21	72.0	2.00
2	E	D Low-E	0.32	0.30	SHGC	0.27/0.21	24.0	2.00
3	S	D Low-E	0.32	0.30	SHGC	0.27/0.21	72.0	2.00
4	N	D Low-E	0.32	0.30	SHGC	0.27/0.21	24.0	2.00

INFILTRATION

Method	CFM 50	ACH 50	ELA	EqLA	SLA	Terrain/Wind Shielding
Prop ACH	1517	7.00	83.3	156.6	0.00036	Suburban/Suburban

Method	CFM 50	ACH 50	ELA	EqLA	SLA	Terrain/Wind Shielding
Prop ACH	867	4.00	47.6	89.5	0.00021	Suburban/Suburban

Building Input Comparison Report

VENTILATION

Run Time Fraction	Forced Vent Supply	Forced Vent Exhaust	Recovery Efficiency Sensible	Recovery Efficiency Latent	Power Usage Vent Fan	Power Usage Added AH
	cfm	cfm			W	W

Run Time Fraction	Forced Vent Supply	Forced Vent Exhaust	Recovery Efficiency Sensible	Recovery Efficiency Latent	Power Usage Vent Fan	Power Usage Added AH
	cfm	cfm			W	W

GARAGE

#	Floor Area	Roof Area	Wall Area	Wall Perimeter	Wall Insulation	Exp Wall Insulation
1	528 ft²	528 ft²	(invalid) ft²	68 ft	(invalid)	1.5

#	Floor Area	Roof Area	Wall Area	Wall Perimeter	Wall Insulation	Exp Wall Insulation
1	528 ft²	528 ft²	(invalid) ft²	68 ft	(invalid)	1.5

MASS

Mass Type	Area	Thickness
No Added Mass	0 ft²	0 ft

Mass Type	Area	Thickness
No Added Mass	0 ft²	0 ft

AIR CONDITIONING

#	Efficiency	Capacity	Air Flow

#	Efficiency	Capacity	Air Flow

HEATER

#	System Type	Efficiency	Capacity
1	Natural Gas Furnace	HSPF: 0.78	100 kBtu/hr

#	System Type	Efficiency	Capacity
1	Natural Gas Furnace	HSPF: 0.78	100 kBtu/hr

DUCTS

#	---- Supply ---- Location	R-Val	Return Location	Air Handler	Leakage Type	% Leak	RLF
1	Basement	0.5	Basement	Basement	Default Leakage		

#	---- Supply ---- Location	R-Val	Return Location	Air Handler	Leakage Type	% Leak	RLF
1	Basement	0.5	Basement	Basement	Default Leakage		

HOT WATER

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Natural Gas	0.59	40 gal	60 gal	120 deg	None

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Natural Gas	0.59	40 gal	60 gal	120 deg	None

SOLAR HOT WATER

Collector Type	Collector Tilt	Azimuth	Loss Coeff.	Absorp. Prod.

Collector Type	Collector Tilt	Azimuth	Loss Coeff.	Absorp. Prod.

Building Input Comparison Report

TEMPERATURE

Programmable Thermostat: N	Ceiling Fans: N			Programmable Thermostat: N	Ceiling Fans: N		
Schedule Name: IECC 2006 Reference				Schedule Name: IECC 2006 Reference			
Schedule Type	Minimum	Maximum	Average	Schedule Type	Minimum	Maximum	Average
Cooling (WD)	78	78	78	Cooling (WD)	78	78	78
Cooling (WEH)	78	78	78	Cooling (WEH)	78	78	78
Heating (WD)	68	68	68	Heating (WD)	68	68	68
Heating (WEH)	68	68	68	Heating (WEH)	68	68	68

APPLIANCES & LIGHTING

Schedule Name: IECC 2006 Reference					Schedule Name: HERS 2006 Reference				
Schedule Type	Minimum	Maximum	Average	Peak	Schedule Type	Minimum	Maximum	Average	Peak
Ceiling Fans (Summer)	0.3	1	0.6	0	Ceiling Fans (Summer)	0.3	1	0.6	0
Dishwasher	0	1	0.4	44	Dishwasher	0	1	0.4	44
Dryer	0.1	1	0.5	200	Dryer	0.1	1	0.5	200
Lighting	0.1	1	0.3	420	Lighting	0.1	1	0.3	420
Miscellaneous	0.5	1	0.6	348	Miscellaneous	0.5	1	0.6	348
Pool Pump	0	1	0.3	0	Pool Pump	0	1	0.3	0
Range	0.1	1	0.3	165	Range	0.1	1	0.3	165
Refrigeration	0.7	1	0.8	106	Refrigeration	0.7	1	0.8	106
Well Pump	0.1	0.1	0.1	0	Well Pump	0.1	0.1	0.1	0

PHOTOVOLTAICS

Annual Energy Summary

Mt Energy+Design
NA
Great Falls, Mt, 59401-
Registration #:

Title: Energy Code - Base #1 Tot-C
User

TMY City: MT_GREATFALLS
Elec Util: NW Energy - Livingsto
Gas Util: NW Energy - Livingsto
Run Date: 03/26/2009 13:52:25

MEC-2009 IEEC - Base house - Tot-C

End-Use	Energy Consumption	Annual Cost
Cooling (kBtu/hr)	0 kWh	$0
Cooling Fan	0 kWh	$0
Mechanical Vent Fan	16 kWh	$ 2
Total Cooling	**16 kWh**	**$2**
Heating (100 kBtu/hr)	384 Therms	$449
Heating Fan/Pump	254 kWh	$26
Mechanical Vent Fan	144 kWh	$ 15
Total Heating		**$490**
Hot Water	213 Therms	$249
Hot Water Pump	0 kWh	$0
Total Hot Water		**$249**
Ceiling Fans	0 kWh	$0
Clothes Washer	105 kWh	$11
Dishwasher	145 kWh	$15
Dryer	891 kWh	$91
Lighting	1285 kWh	$131
Miscellaneous	1896 kWh	$193
Pool Pump	0 kWh	$0
Range	447 kWh	$46
Refrigerator	775 kWh	$79
Total (kWh)	5958 kWh	$609
Total (Therms)	597 Therms	$698
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost		$1307

* Assumes net metering

Emissions (Calculated as Total - PV Produced)

SO2	10.25 Lbs.
NOX	23.07 Lbs.
CO2	8.16 Tons

Annual Energy Summary

Mt Energy+Design
NA
Great Falls, Mt, 59401-
Registration #:

Title: Energy Code - Base #1 Tot-B
User

TMY City: MT_GREATFALLS
Elec Util: NW Energy - Livingsto
Gas Util: NW Energy - Livingsto
Run Date: 03/26/2009 13:49:15

MEC-2009 IEEC - Base house - Tot-B

End-Use	Energy Consumption	Annual Cost
Cooling (kBtu/hr)	0 kWh	$0
Cooling Fan	0 kWh	$0
Mechanical Vent Fan	19 kWh	$ 2
Total Cooling	**19 kWh**	**$2**
Heating (100 kBtu/hr)	583 Therms	$682
Heating Fan/Pump	388 kWh	$40
Mechanical Vent Fan	149 kWh	$ 15
Total Heating		**$737**
Hot Water	213 Therms	$249
Hot Water Pump	0 kWh	$0
Total Hot Water		**$249**
Ceiling Fans	0 kWh	$0
Clothes Washer	105 kWh	$11
Dishwasher	145 kWh	$15
Dryer	891 kWh	$91
Lighting	1285 kWh	$131
Miscellaneous	1896 kWh	$193
Pool Pump	0 kWh	$0
Range	447 kWh	$46
Refrigerator	775 kWh	$79
Total (kWh)	6100 kWh	$623
Total (Therms)	796 Therms	$931
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
* Assumes net metering		
Total Cost		$1554

Emissions (Calculated as Total - PV Produced)

SO2	10.49 Lbs.
NOX	25.29 Lbs.
CO2	9.44 Tons

Annual Energy Summary

Mt Energy+Design
NA
Great Falls, Mt, 59401-
Registration #:

Title: Energy Code - Base #1 Tot-A
User

TMY City: MT_GREATFALLS
Elec Util: NW Energy - Livingsto
Gas Util: NW Energy - Livingsto
Run Date: 03/26/2009 13:43:39

MEC-2009 IEEC - Base house - Tot-A

End-Use	Energy Consumption	Annual Cost
Cooling (kBtu/hr)	0 kWh	$0
Cooling Fan	0 kWh	$0
Mechanical Vent Fan	21 kWh	$ 2
Total Cooling	**21 kWh**	**$2**
Heating (100 kBtu/hr)	653 Therms	$764
Heating Fan/Pump	433 kWh	$44
Mechanical Vent Fan	152 kWh	$ 16
Total Heating		**$824**
Hot Water	214 Therms	$250
Hot Water Pump	0 kWh	$0
Total Hot Water		**$250**
Ceiling Fans	0 kWh	$0
Clothes Washer	105 kWh	$11
Dishwasher	145 kWh	$15
Dryer	891 kWh	$91
Lighting	1285 kWh	$131
Miscellaneous	1896 kWh	$193
Pool Pump	0 kWh	$0
Range	447 kWh	$46
Refrigerator	775 kWh	$79
Total (kWh)	6150 kWh	$628
Total (Therms)	867 Therms	$1014
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost		$1642

* Assumes net metering

Emissions (Calculated as Total - PV Produced)

SO2	10.58 Lbs.
NOX	26.07 Lbs.
CO2	9.89 Tons

Annual Energy Summary

Mt Energy+Design
NA
Great Falls, Mt, 59401-
Registration #:

Title: Energy Code - Base #1
User

TMY City: MT_GREATFALLS
Elec Util: NW Energy - Livingsto
Gas Util: NW Energy - Livingsto
Run Date: 02/19/2009 12:28:55

MEC-2009 IEEC - Base house

End-Use	Energy Consumption	Annual Cost
Cooling (kBtu/hr)	0 kWh	$0
Cooling Fan	0 kWh	$0
Mechanical Vent Fan	2 kWh	$ 0
Total Cooling	**2 kWh**	**$0**
Heating (100 kBtu/hr)	919 Therms	$1075
Heating Fan/Pump	576 kWh	$59
Mechanical Vent Fan	17 kWh	$ 2
Total Heating		**$1136**
Hot Water	219 Therms	$256
Hot Water Pump	0 kWh	$0
Total Hot Water		**$256**
Ceiling Fans	0 kWh	$0
Clothes Washer	105 kWh	$11
Dishwasher	145 kWh	$15
Dryer	891 kWh	$91
Lighting	1735 kWh	$177
Miscellaneous	1896 kWh	$193
Pool Pump	0 kWh	$0
Range	447 kWh	$46
Refrigerator	775 kWh	$79
Total (kWh)	6589 kWh	$673
Total (Therms)	1138 Therms	$1331
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost		$2004

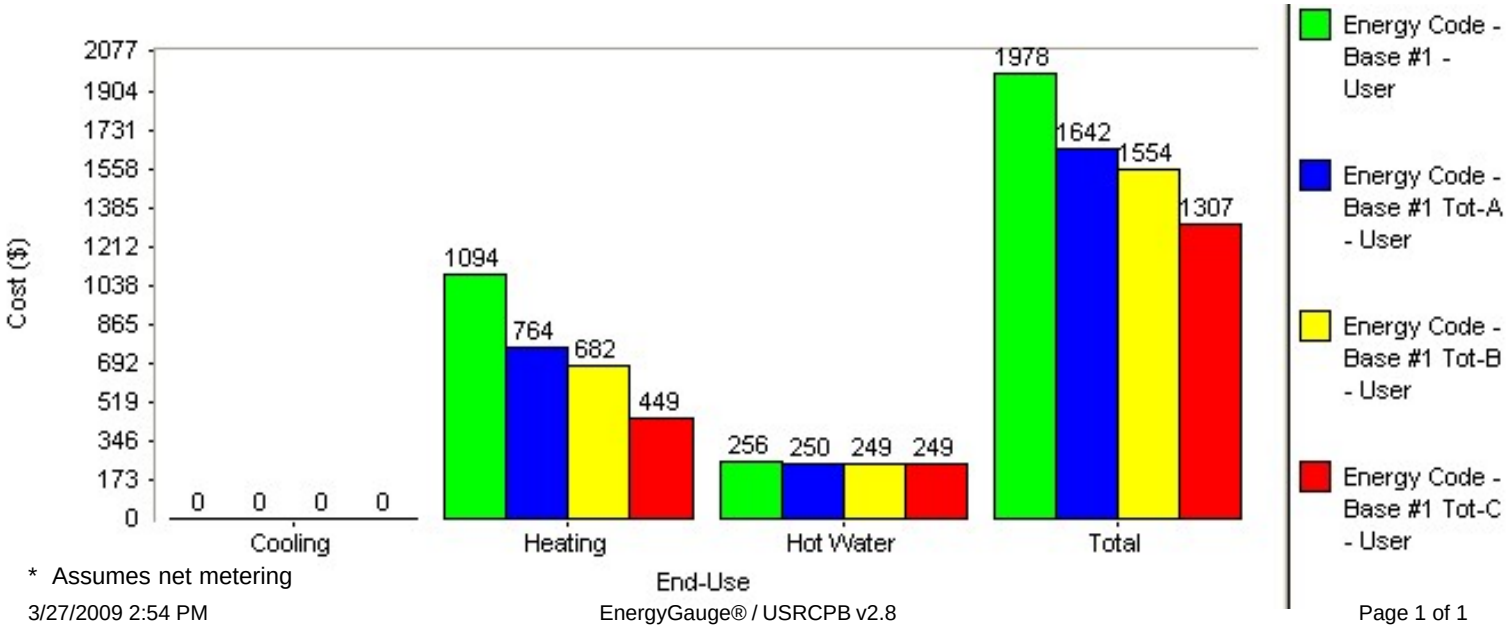
* Assumes net metering

Emissions (Calculated as Total - PV Produced)

SO2	11.33 Lbs.
NOX	29.8 Lbs.
CO2	11.81 Tons

Building Output Comparison Report

	Energy Code - Base User 3/27/2009 2:52:47 PM		Energy Code - Base User 3/27/2009 2:50:09 PM		Energy Code - Base User 3/26/2009 1:49:15 PM		Energy Code - Base User 3/26/2009 1:52:25 PM	
End-Use	Energy	Cost	Energy	Cost	Energy	Cost	Energy	Cost
Cooling	0 kWh	$0	0 kWh	$0	0 kWh	$0	0 kWh	$0
Cooling Fan	0 kWh	$0	0 kWh	$0	0 kWh	$0	0 kWh	$0
Cooling Vent Fan	3 kWh	$0	21 kWh	$2	kWh	$	16 kWh	$2
Heating	935 Therm	$1094	653 Therm	$764	583 Therm	$682	384 Therm	$449
Heating Fan/Pump	587 kWh	$60	433 kWh	$44	388 kWh	$40	254 kWh	$26
Heating Vent Fan	17 kWh	$2	152 kWh	$16	149 kWh	$15	144 kWh	$15
Hot Water	219 Therm	$256	214 Therm	$250	213 Therm	$249	213 Therm	$249
Hot Water Pump	0 kWh	$0	0 kWh	$0	0 kWh	$0	0 kWh	$0
Ceiling Fans	0 kWh	$0	0 kWh	$0	0 kWh	$0	0 kWh	$0
Clothes Washer	105 kWh	$11	105 kWh	$11	105 kWh	$11	105 kWh	$11
Dishwasher	145 kWh	$15	145 kWh	$15	145 kWh	$15	145 kWh	$15
Dryer	891 kWh	$91	891 kWh	$91	891 kWh	$91	891 kWh	$91
Lighting	1285 kWh	$131	1285 kWh	$131	1285 kWh	$131	1285 kWh	$131
Miscellaneous	1896 kWh	$193	1896 kWh	$193	1896 kWh	$193	1896 kWh	$193
Pool Pump	0 kWh	$0	0 kWh	$0	0 kWh	$0	0 kWh	$0
Range	447 kWh	$46	447 kWh	$46	447 kWh	$46	447 kWh	$46
Refrigerator	775 kWh	$79	775 kWh	$79	775 kWh	$79	775 kWh	$79
Total *(kWh)*	6151 kWh	$628	6150 kWh	$628	6100 kWh	$623	5958 kWh	$609
Total *(Therms)*	1154 Ther	$1350	867 Therm	$1014	796 Therm	$931	597 Therm	$698
Total *(Oil Gallons)*	0 Gallons	$0	0 Gallons	$0	0 Gallons	$0	0 Gallons	$0
Total *(Propane Gallons)*	0 Gallons	$0	0 Gallons	$0	0 Gallons	$0	0 Gallons	$0
PV Produced *(kWh)* *	0 kWh	$0	0 kWh	$0	0 kWh	$0	0 kWh	$0
Total Cost		$1978		$1642		$1554		$1307
Emissions (Calculated as Total - PV Produced)								
SO2	10.58 Lbs.		10.58 Lbs.		10.49 Lbs.		10.25 Lbs.	
NOX	28.7 Lbs.		26.07 Lbs.		25.29 Lbs.		23.07 Lbs.	
CO2	11.56 Tons		9.89 Tons		9.44 Tons		8.16 Tons	



* Assumes net metering

BIOGRAPHICAL SKETCH:

Jim Baerg
dba **Montana Energy+Design**

Jim Baerg was raised on a farm on the hi-line and graduated from Glasgow High School. After attending the University of Montana for several years, he moved to the Gallatin Valley. He was an early proponent and practitioner of Energy Efficient residential construction, starting in the mid 1970's.

Jim designed and built energy efficient houses in Gallatin and Park Counties into the mid 1980's until the effects of the first energy crisis subsided. He also is responsible for several commercial scale greenhouses and numerous attached residential greenhouses. Jim also sold a line of insulated window coverings for many years. His design work has always been based on the art of combining livable, affordable and efficient features. Jim's knowledge of thermodynamics, Montana weather and building design strategies is based on long experience and a close reading of leading technical reports. He has used energy analysis in his design work since the days of hand-held programmable calculators.

Jim Baerg has also had considerable experience with historic restoration and remodeling. He is particularly proud of his work restoring the Tinsley Homestead House at the Museum of the Rockies in Bozeman. He currently resides in a 1914 brick house that is (slowly) undergoing a thorough energy renovation.

Jim was active in the SW Montana Homebuilders Association, serving for a time on the Board and one term as President of the Association. He is also a founding member of the Bozeman (Crossroads) Food Coop, and of AERO, the Alternative Energy Resources Organization, now located in Helena. His work included organizing the first Alternative Agriculture conference in Billings in 1976, serving as the Technical Director of the New Western Energy Show, and leading many solar hot water collector workshops around the state. Jim taught numerous energy efficient courses, wrote articles and lectured.

In the mid 1990's, Jim and his family moved to Seattle to work and pursue graduate school. While there, he spent two years with Schultz Miller Construction, one of Seattle's top high-end remodeling contractors. Jim received a Masters in Architecture at UW working with a number of leading sustainable designers who were at the forefront of Seattle's sustainable building boom. Upon graduation, Jim worked as an Intern Architect for Balance Associates in Seattle, primarily on residential house design.

Jim and his family returned to Montana in the summer of 2006. He worked as an Architect-in-Training for Van Bryan Studio Architects in Bozeman before opening his own design and consulting office in Livingston. **Montana Energy+Design** focuses on sustainable building design, consulting on technical energy issues and supporting sustainable community projects. Jim is currently studying for his licensing exams.

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