COST EFFECTIVENESS OF THE 2000 INTERNATIONAL ENERGY CONSERVATION CODE IN MICHIGAN

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The current Michigan state code for energy efficiency in residential buildings is the *Michigan Uniform Energy Code* (MUEC) (MDCIS 1999). The MUEC has requirements that ensure a minimal level of energy efficiency. A more stringent code is the International Code Council's (ICC) 2000 *International Energy Conservation Code* (IECC) (ICC 1999). The 2000 IECC, earlier editions of the IECC, and its predecessor, the Model Energy Code, have been widely adopted in other states.

The U.S. Department of Energy (DOE) has requested Pacific Northwest National Laboratory (PNNL) to estimate the energy savings and economic impacts (the simple payback) from adopting the 2000 IECC for new residential buildings in Michigan. The results of this analysis are presented below.

Methodology

The analysis examined the typical cost and energy savings from the incremental improvements to the MUEC from adopting the 2000 IECC. Three locations in Michigan were examined: Ann Arbor, Traverse City, and Escanaba. These cities represent Zones 1, 2, and 3 (southern, middle, and northern Michigan) in the MUEC.

Three house designs were considered.

- a 2000 ft^2 two-story house, 25x40 ft, 15% window–to-wall area ratio
- a 1629 ft^2 cape house – 28x36 ft, 11.7% window-to-wall area ratio
- a 998 ft^2 one-story house – 24x42 ft, 13.3% window-to-wall area ratio.

These relatively small houses were selected to focus on the impact on financially limited, first-time homebuyers. All of the houses were assumed to have full basements. Most houses in Michigan will have a fenestration area of 15% or less.

The RES*check* software, developed by the U.S. Department of Energy,[1] allows users to easily examine different energy efficiency measures to determine if they comply with a particular code. The energy efficiency requirements were set in RES*check* to match the MUEC requirements and then incrementally improved until 2000 IECC compliance was achieved. RES*check* was utilized to determine what combinations of measures (packages) could be used to comply with the 2000 IECC for the locations and houses included in this study. These packages were then used in the energy analysis.

Code Requirements

Both the 2000 IECC and the MUEC have similar multiple methods of compliance. There are prescriptive sets of requirements that contain envelope specifications based on the climate zone and the percentage of opening area to gross wall area. The IECC includes only windows (not

[1] http://www.energycodes.gov/REScheck.

doors) in the opening-to-wall area ratio and the gross wall area for the MUEC includes basements walls, whereas the IECC does not. The "systems analysis" approaches provide much more flexibility, allowing combinations of energy efficiency measures to comply as long as the total annual energy use is at or below a limit.

The prescriptive requirements for the MUEC are shown in Table 1. These requirements were used in the energy analysis. A gas furnace with an efficiency of 80% and an air conditioner with a Seasonal Energy Efficiency Ratio (SEER) of 10 were assumed.

Table 1. MUEC Prescriptive Compliance Approach Building Envelope Insulation Criteria

Building Component	Zone 1	Zone 2	Zone 3
R 408.31074 walls	R-13	R-15	R-19
R 408.31075 fenestration/openings			
Up to and including 15% gross exterior wall area	R-1.9	R-1.9	R-1.9
Over 15% and including 20% gross exterior wall area	R-2.5	R-2.5	R-2.5
Over 20% gross exterior wall area	Trade-off	Trade-off	Trade-off
R 408.31076 roof/ceiling Skylights follow fenestration requirements for R values and are limited to 10% of gross roof/ceiling area	R-30	R-38	R-38
R 408.31077 floors over unconditioned spaces (including outdoor overhangs)	R-21	R-30	R-30
R 408.31078 slab-on-grade floors			
Unheated slabs	R-5	R-5	R-5
Heated slabs	R-10	R-10	R-10
R 408.31079 crawl space walls	R-5	R-5	R-5
R 408.31080 finished lower level walls	R-5	R-5	R-5
R 408.31081 exposed basement walls (Insulation is required to reduce the above-ground wall area to 7% of the gross exterior wall area or less)	R-5	R-5	R-5

The 2000 IECC has requirements for energy efficiency in all types of buildings. The code has separate requirements for residential buildings (three stories or less in height above grade) and all other types of buildings. The residential building requirements are contained in Chapters 1, 4, 5, and 6 of the code. The building envelope requirements (ceiling, wall, and foundation insulation and window U-factor) vary based on the heating-degree-days—a measure of the overall severity of the winter. Therefore, northern Michigan locations have slightly more stringent requirements than southern Michigan locations. The IECC also has basic requirements that do not vary by climate. Most notably, the building envelope and air ducts are required to be carefully sealed and ducts passing through unconditioned spaces must be insulated.

If the basement is not conditioned, the MEUC and 2000 IECC have similar requirements for floor insulation above the basement[2]. However, if the basement is conditioned, the MEUC does not require insulation if the basement is unfinished and the area of basement wall above finished grade is less than 7 percent of gross exterior wall area. Conversely, basement wall insulation is an IECC requirement that essentially cannot be traded-off—there are not enough improvements possible in other measures to make up for a lack of basement insulation. Therefore, this analysis assumed the basements were conditioned.

Incremental Measures

The energy efficiency specification inputs into RES*check* were initially set to match the MUEC requirements. Then, incremental improvements in energy efficiency were input to the software until compliance with the 2000 IECC was achieved. The most significant incremental measure is the addition of basement wall insulation. Another option that assists greatly in complying with the IECC is to increase the furnace efficiency to 90% or higher. These high efficiency furnaces have a 28% market share nationwide[3]. A third method of improving energy efficiency is through the use of low-E windows, which generally have a U-factor of about 0.32 to 0.40. Low-E windows are already common in colder climates, even in locations without an energy code. Finally, 2x6 stud walls with R-19 insulation is a good method for assisting in meeting the IECC. In fact, this is a requirement in the prescriptive paths in the IECC for all of Michigan and in the MUEC for the coldest zone. However, the option of R-19 walls was not chosen in this analysis unless the MUEC already required it because the other improvements were considered to be less costly and more acceptable to builders.

Tables 2 through 4 show the sets of measures selected for the energy analysis to reach compliance with the 2000 IECC. Appendix A contains the printed output files from the RES*check* software.

Table 2. IECC Compliance Measures for the 2000 ft^2 Two-Story House

		Ceiling R-value	Wall R-value	Window U-factor	Basement Wall R-value	Furnace AFUE[(a)]
Zone 1	Ann Arbor	30	13	0.40	11	90%
Zone 2	Traverse City	38	15	0.40	11	90%
Zone 3	Escanaba	38	19	0.36	11	80%

[(a)] annual fuel utilization efficiency

[2] The 2000 IECC requires ducts to be insulated in unconditioned spaces, where the MUEC does not. However, the 2003 update to the MUEC does require ducts to be insulated.

[3] http://www.gamanet.org/press/AFUEPR2002.pdf (accessed 12/9/03).

Table 3. IECC Compliance Measures for the 1629 ft^2 Cape House

		Ceiling R-value	Wall R-value	Window U-factor	Basement Wall R-value	Furnace AFUE
Zone 1	Ann Arbor	30	13	0.50	11	90%
Zone 2	Traverse City	38	15	0.50	11	90%
Zone 3	Escanaba	38	19	0.40	11	80%

Table 4. IECC Compliance Measures for the 998 ft^2 One-Story House

		Ceiling R-value	Wall R-value	Window U-factor	Basement Wall R-value	Furnace AFUE
Zone 1	Ann Arbor	30	13	0.50	11	90%
Zone 2	Traverse City	38	15	0.40	11	90%
Zone 3	Escanaba	38	19	0.35	11	80%

Fuel Costs

Fuel costs were obtained from DOE Energy Information Administration data for Michigan (2003). Heating is assumed to be by natural gas. The average fuel cost of $6.2/Mcf from the winter of 2002/2003 was used. The current indications are that natural gas prices will be moderately higher in the winter of 2003/2004. The average July 2003 Michigan residential electricity price of 8.85 cents/kWh was used for air conditioning.

Construction Cost Data

All costs reported here are incremental—the marginal cost of improving from the level required by the MUEC to the level required by the 2000 IECC.

Basement wall insulation can be on either the inside of the basement wall (typically R-11 or R-13), or on the outside of the basement wall (typically sheathing insulation such as polystyrene). Insulating concrete forms can also be used. The Building Science Corporation estimates the costs to properly insulate (but not finish) a 140-ft perimeter basement at $840[4]. A Midwest builder estimated the cost of basement wall insulation at $900 (Energy Design Update 1998). *Builder Magazine* reports that a Colorado builder estimates total costs of $500 to $1000 for R-11 vinyl wrap (NAHB 1996). A cost of $900 was assumed for this analysis. This cost is in general

[4] http://www.buildingscience.com/resources/foundations/basement_insulation_systems.pdf (accessed 12/9/03)

agreement with the estimate from Michigan Energy Services for the proposed update to the MUEC[5].

A 90% (or higher) annual fuel utilization efficiency (AFUE) condensing furnace is a substantial improvement in efficiency over a standard furnace with an efficiency of about 80%. A Wisconsin study indicates that the average cost of improving from a standard efficiency furnace to the 90% efficiency condensing furnace is $464 (Energy Center of Wisconsin 1997). California data gives an incremental installed price of $654 for an 80 kBtu/hr 90% AFUE gas furnace (Xenergy 2001). A Midwest builder reported the cost at $500 (Energy Design Update 1998). An incremental cost of $500 was assumed for this analysis.

Low-E windows are assumed as a method of complying with the IECC in some of the scenarios examined here. The incremental cost of the addition of low-E to a wood or vinyl double-paned window is assumed to be $1.00/ft^2 here. The U-factor of low-E windows was assumed to be U-0.35, though U-0.40 was sufficient to comply with the IECC in most scenarios examined here. Most wood and vinyl window products with low-E have a U-factor of 0.35 or less.

Energy Simulations

The Energy-10 simulation tool (Sustainable Buildings Industry Council 2003) was used to estimate the savings from improving energy efficiency requirements for the MUEC versus the 2000 IECC. A heating setpoint of 70° F and a cooling setpoint of 78° F were assumed. Other than shown in Tables 1 through 4 above, all inputs for the IECC simulations and the MUEC simulations were set to be identical. Appendix B contains the complete input and output information for the simulations. The IECC runs are shown in the left columns; the MUEC runs are in the right. Because weather data is available for only a limited number of cities in Energy-10, Detroit and Sault Ste. Marie were used for Zones 1 and 3, respectively.

Tables 5 through 13 show the energy and economic impacts for the improvements needed to comply with the 2000 IECC. Energy savings are at least $300 in all cases. The first cost increase is between $1000 and $1700, with more than half the cost being for the basement wall insulation. The simply payback is under 5 years in all cases.

As mentioned above, basement wall insulation is perhaps the most significant additional requirement in the 2000 IECC. Basement wall insulation can have a high cost, but also a large benefit in terms of energy savings. Estimating the heat transfer from basement walls is complicated because of the three-dimensional geometry and the high thermal mass of the ground. Perimeter conduction factors of 1.94 Btu/hr-F-ft for an uninsulated basement and 0.78 Btu/hr-F-ft for a basement with R-11 insulation were used (Lawrence Berkeley National Laboratory 1998).

A rationality check of the results for basement wall insulation was done. Perhaps the most detailed analysis of foundation heat transfer in residential construction was done by the Underground Space Center at the University of Minnesota (Labs et al. 1988). The results of this

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[5] From the Regulatory Impact Statement for the proposed revision to the MUEC:

The proposed rules require basement insulation to provide for lower energy usage. Residential builders who do not currently insulate basement areas will experience an additional cost of approximately $800 for required materials.

http://www.state.mi.us/orr/emi/rules.asp?type=Number&id=40831001&subId=2003%2D015+CI+&subCat=RIS (accessed 12/9/03)

analysis for Chicago (the city most similar in climate to Michigan, included in the 1988 analysis) are used here to examine the cost effectiveness of basement wall insulation. For a fully conditioned deep basement[6], R-10 interior insulation 8-ft deep reduces heating energy use by 0.35 MBtu/lineal foot of foundation perimeter in Chicago. At the Michigan natural gas cost, this is an annual energy cost impact of $2.1/lineal foot. The total impacts for insulating a 130-foot perimeter house are about $280 a year in energy savings. Impacts of the basement insulation on cooling energy use in Chicago are small. This confirms that basement wall insulation saves a large amount of energy in heated basements in cold climates.

[6] A deep basement has 1-ft exposed above grade.

Table 5. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 2000 ft^2 Two-Story House – Climate Zone 1

	2000 IECC	MUEC
Heating	$523	$882
Cooling	$126	$105
Fan (heat+cool)	$79	$93
Total	$728	$1080
Energy savings	$352	
First cost increase	500+900+332*1=$1732	
Simple payback	1732/352 = **4.9 years**	

Table 6. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 1629 ft^2 Cape House – Climate Zone 1

	2000 IECC	MUEC
Heating	$380	$678
Cooling	$82	$65
Fan (heat+cool)	$56	$75
Total	$578	$887
Energy savings	$309	
First cost increase	500+900=$1400	
Simple payback	1400/309 = **4.5 years**	

Table 7. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 998 ft^2 One-Story House – Climate Zone 1

	2000 IECC	MUEC
Heating	$374	$674
Cooling	$56	$42
Fan (heat+cool)	$45	$66
Total	$475	$782
Energy savings	$307	
First cost increase	500+900=$1400	
Simple payback	1400/307= **4.6 years**	

Table 8. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 2000 ft^2 Two-Story House – Climate Zone 2

	2000 IECC	MUEC
Heating	$590	$1000
Cooling	$105	$84
Fan (heat+cool)	$75	$101
Total	$770	$1185
Energy savings	$415	
First cost increase	500+900+332*1=$1732	
Simple payback	1732/415 = **4.2 years**	

Table 9. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 1629 ft^2 Cape House – Climate Zone 2

	2000 IECC	MUEC
Heating	$496	$845
Cooling	$63	$49
Fan (heat+cool)	$58	$83
Total	$617	$977
Energy savings	$360	
First cost increase	500+900=$1400	
Simple payback	1400/360 = **3.9 years**	

Table 10. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 998 ft^2 One-Story House – Climate Zone 2

	2000 IECC	MUEC
Heating	$400	$763
Cooling	$44	$32
Fan (heat+cool)	$46	$73
Total	$490	$868
Energy savings	$378	
First cost increase	500+900+156=$1556	
Simple payback	1556/378= **4.1 years**	

Table 11. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 2000 ft^2 Two-Story House – Climate Zone 3

	2000 IECC	MUEC
Heating	$720	$1145
Cooling	$41	$22
Fan (heat+cool)	$70	$104
Total	$831	$1271
Energy savings	$440	
First cost increase	900+332*1=$1232	
Simple payback	1232/440 = **2.8 years**	

Table 12. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 1629 ft^2 Cape House – Climate Zone 3

	2000 IECC	MUEC
Heating	$611	$986
Cooling	$18	$6
Fan (heat+cool)	$57	$87
Total	$686	$1079
Energy savings	$392	
First cost increase	900+181=$1181	
Simple payback	1181/392 = **3.0 years**	

Table 13. Annual Energy Cost Savings, First Cost Increase, and Simple Payback for the 998 ft^2 One-Story House – Climate Zone 3

	2000 IECC	MUEC
Heating	$499	$888
Cooling	$10	$3
Fan (heat+cool)	$45	$77
Total	$554	$968
Energy savings	$413	
First cost increase	900+151=$1051	
Simple payback	1051/413= **2.5 years**	

Conclusion

The IECC has the flexibility to allow builders to find the lowest cost method of meeting the code requirements, and RES*check* (and other simulation tools) allows this flexibility to be easily exploited. Other options of energy conservation measures that comply are available. For homes with fully conditioned basements, the energy savings from the improved efficiency will recoup the increased construction costs in 3 to 5 years. Accounting for the impacts of a typical mortgage, a net positive cash flow will be even quicker because the energy savings will easily exceed the increased mortgage payments.

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Appendix A - RES*check* Compliance Certificate
2000 IECC

RES*check* Software Version 3.5 Release 1c

ZONE 1 – 2000 FT^2 HOUSE – HEATED BASEMENT
CITY: Ann Arbor
STATE: Michigan
HDD: 6379
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 423
Your Home UA = 399
5.7% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	1000	30.0	0.0		35
Wall 1: Wood Frame, 16" o.c.	2210	13.0	0.0		151
Window 1: Vinyl Frame:Double Pane with Low-E	332			0.400	133
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1040	11.0	0.0		66
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 90 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 1 – 1629 FT^2 HOUSE – HEATED BASEMENT
CITY: Ann Arbor
STATE: Michigan
HDD: 6379
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 331
Your Home UA = 318
3.9% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	747	30.0	0.0		26
Ceiling 2: Cathedral Ceiling (no attic)	369	30.0	0.0		13
Wall 1: Wood Frame, 16" o.c.	1545	13.0	0.0		109
Window 1: Wood Frame:Double Pane	181			0.500	91
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1024	11.0	0.0		65
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 90 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 1 – 998 FT^2 HOUSE – HEATED BASEMENT
CITY: Ann Arbor
STATE: Michigan
HDD: 6379
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 277
Your Home UA = 274
1.1% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	998	30.0	0.0		35
Wall 1: Wood Frame, 16" o.c.	1170	13.0	0.0		80
Window 1: Vinyl Frame:Double Pane	156			0.500	78
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1056	11.0	0.0		67
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 90 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 2 – 2000 FT^2 HOUSE – HEATED BASEMENT
CITY: Traverse City
STATE: Michigan
HDD: 7749
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 396
Your Home UA = 385
2.8% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	1000	38.0	0.0		30
Wall 1: Wood Frame, 16" o.c.	2210	15.0	0.0		142
Window 1: Vinyl Frame:Double Pane with Low-E	332			0.400	133
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1040	11.0	0.0		66
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 90 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 2 – 1629 FT^2 HOUSE – HEATED BASEMENT
CITY: Traverse City
STATE: Michigan
HDD: 7749
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 313
Your Home UA = 304
2.9% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	747	38.0	0.0		22
Ceiling 2: Cathedral Ceiling (no attic)	369	38.0	0.0		10
Wall 1: Wood Frame, 16" o.c.	1545	15.0	0.0		102
Window 1: Vinyl Frame:Double Pane	181			0.500	91
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1024	11.0	0.0		65
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 90 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 2 – 998 FT^2 HOUSE – HEATED BASEMENT
CITY: Traverse City
STATE: Michigan
HDD: 7749
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 262
Your Home UA = 248
5.3% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	998	38.0	0.0		30
Wall 1: Wood Frame, 16" o.c.	1170	15.0	0.0		75
Window 1: Vinyl Frame:Double Pane with Low-E	156			0.400	62
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1056	11.0	0.0		67
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 90 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 3 – 2000 FT^2 HOUSE – HEATED BASEMENT
CITY: Escanaba
STATE: Michigan
HDD: 8593
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 341
Your Home UA = 340
0.3% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	1000	38.0	0.0		30
Wall 1: Wood Frame, 16" o.c.	2210	19.0	0.0		110
Window 1: Vinyl Frame:Double Pane with Low-E	332			0.360	120
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1040	11.0	0.0		66
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 80 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 3 – 1629 FT^2 HOUSE – HEATED BASEMENT
CITY: Escanaba
STATE: Michigan
HDD: 8593
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 268
Your Home UA = 262
2.2% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	747	38.0	0.0		22
Ceiling 2: Cathedral Ceiling (no attic)	369	38.0	0.0		10
Wall 1: Wood Frame, 16" o.c.	1545	19.0	0.0		79
Window 1: Vinyl Frame:Double Pane with Low-E	181			0.400	72
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1024	11.0	0.0		65
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 80 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

ZONE 3 – 998 FT^2 HOUSE – HEATED BASEMENT
CITY: Escanaba
STATE: Michigan
HDD: 8593
CONSTRUCTION TYPE: Single Family
DATE: 12/02/03
COMPLIANCE: Passes

Maximum UA = 224
Your Home UA = 224
0.0% Better Than Code (UA)

	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	998	38.0	0.0		30
Wall 1: Wood Frame, 16" o.c.	1170	19.0	0.0		58
Window 1: Vinyl Frame:Double Pane with Low-E	156			0.350	55
Door 1: Solid	40			0.350	14
Basement Wall 1: Solid Concrete or Masonry	1056	11.0	0.0		67
Wall height: 8.0'					
Depth below grade: 7.0'					
Insulation depth: 8.0'					
Furnace 1: Forced Hot Air, 80 AFUE					
Air Conditioner 1: Electric Central Air, 10 SEER					

Appendix B – Energy-10 Input/Output Reports

Energy-10 Summary Page Dec 02, 2003
Project: Detriot1 **Project Directory:** C:\Program Files\Energy10v1_6\DETRIOT2000

	IECC	MSEC
Description:		
Scheme Number:	1 / Saved	3 / Saved
Library Name:	ARCHIVELIB	ARCHIVELIB
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:		Like IECC but:
.5 instead of		
Weather file:	DETROIT.ET1	DETROIT.ET1
Floor Area, ft²	2000.0	2000.0
Surface Area, ft²	4210.0	4210.0
Volume, ft³	17000.0	17000.0
Total Conduction UA, Btu/h-F	433.2	617.2
Average U-value, Btu/hr-ft²-F	0.103	0.147
Wall Construction	2 x 4 frame, R=12.6	2 x 4 frame, R=12.6
Roof Construction	attic, r-30, R=29.4	attic, r-30, R=29.4
Floor type, insulation	Basement, Reff=9.9	Basement, Reff=4.0
Window Construction	u=0.40, shgc0.40, 27.6 sqft, U=0.40,etc	u=0.50, shgc0.40, 27.6 sqf
.50,etc		
Window Shading	None	None
Wall total gross area, ft²	2210	2210
Roof total gross area, ft²	1000	1000
Ground total gross area, ft²	1000	1000
Window total gross area, ft²	332	332
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.40, shgc-0.40, U=0.40	u0.50, shgc-0.40, U=0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	48/23/31	63/25/33
Rated Air Flow/MDOA,cfm	1163/0	1284/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff-90,EER-8.9	eff-80,EER-8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	8/5	8/5
Peak Gains: IL,EL,MW,OT: W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in²	ACH-0.4	ACH-0.4

Results:

Energy cost	0.603$/Therm,0.089$/kWh,0.000$/kW	0.603$/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	136441	195754
Energy cost, $	1422	1774
Saved by daylighting, kWh	-	NA
Total Electric, kWh	8020	8741
Internal/External lights, kWh	1572/171	1572/171
Heating/Cooling/Fan, kWh	0/1424/989	0/3188/1046
Hot water/Other, kWh	0/4764	0/4764
Peak Electric, kW	4.7	5.1
Fuel, hw/heat/total, kBtu	19564/86781/106345	19564/146362/165926
Emissions, CO2/SO2/NOx, lbs	24413/81/50	31344/87/57
Construction Costs	311299	311590
Life-Cycle Cost	359624	370015

Energy-10 Summary Page Dec 02, 2003
Project: Detriot2 **Project Directory:** C:\Program Files\Energy10v1_6\DETRIOT2

	IECC	MUEC
Description:		
Scheme Number:	1 / Not Saved	5 / Not Saved
Library Name:	ARCHIVELIB	ARCHIVELIB
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:	IECC	MUEC
Weather file:	DETROIT.ET1	DETROIT.ET1
Floor Area, ft²	1629.0	1629.0
Surface Area, ft²	3669.0	3669.0
Volume, ft³	13846.5	13846.5
Total Conduction UA, Btu/h-F	348.8	499.6
Average U-value, Btu/hr-ft²-F	0.095	0.136
Wall Construction	2 x 4 frame, R-12.6	2 x 4 frame, R-12.6
Roof Construction	attic, r-30, R-29.4	attic, r-30, R-29.4
Floor type, insulation	Basement, Reff-9.9	Basement, Reff-4.0
Window Construction	u-0.50, shgc0.40, 15.08 sqft, U-0.47,etc	u-0.50, shgc0.40, 15.08 sq
.47,etc		
Window Shading	None	None
Wall total gross area, ft²	1545	1545
Roof total gross area, ft²	1116	1116
Ground total gross area, ft²	1008	1008
Window total gross area, ft²	181	181
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.50, shgc-0.40, U-0.50	u0.50, shgc-0.40, U-0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	39/16/22	52/18/24
Rated Air Flow/MOOA,cfm	821/0	1050/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff-90,EER-8.9	eff-80,EER-8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	0/5	0/5
Peak Gains: IL,EL,MW,OT: W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in³	ACH-0.4	ACH-0.4

Results:

Energy cost	0.603$/Therm,0.089$/kWh,0.000$/kW	0.603$/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	112273	163330
Energy cost, $	1146	1453
Saved by daylighting, kWh	-	NA
Total Electric, kWh	6859	6889
Internal/External lights, kWh	1280/140	1280/140
Heating/Cooling/Fan, kWh	0/926/633	0/937/851
Hot water/Other, kWh	0/3880	0/3880
Peak Electric, kW	3.5	3.9
Fuel, hw/heat/total, kBtu	15935/72933/88868	15935/123891/139826
Emissions, CO2/SO2/NOx, lbs	19714/64/40	25771/70/46
Construction Costs	251810	252942
Life-Cycle Cost	290491	299981

Energy-10 Summary Page Dec 02, 2001
Project: Detroit1 **Project Directory:** C:\Program Files\Energy10v1_6\DETROIT1

	IECC	MOEC
Description:		
Scheme Number:	1 / Not Saved	3 / Not Saved
Library Name:	ARCHIVELIB	ARCHIVELIB
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:	IECC	MOEC
Weather file:	DETROIT.ET1	DETROIT.ET1
Floor Area, ft²	998.0	998.0
Surface Area, ft²	3118.0	3118.0
Volume, ft³	8483.0	8483.0
Total Conduction UA, Btu/h-F	305.9	456.7
Average U-value, Btu/hr-ft²-F	0.098	0.146
Wall Construction	2 x 4 frame, R=12.6	2 x 4 frame, R=12.6
Roof Construction	attic, r-30, R=29.4	attic, r-30, R=29.4
Floor type, insulation	Basement, Reff=9.8	Basement, Reff=4.0
Window Construction	u-0.50, shgc0.40, 13 sqft, U-0.50,etc	u-0.50, shgc0.40, 13 sqft, U-0,etc
Window Shading	None	None
Wall total gross area, ft²	1122	1122
Roof total gross area, ft²	998	998
Ground total gross area, ft²	998	998
Window total gross area, ft²	156	156
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.50, shgc-0.40, U-0.50	u0.50, shgc-0.40, U-0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	31/13/17	44/14/19
Rated Air Flow/MODA,cfm	643/0	901/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff-90,EER-8.9	eff-80,EER-8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	8/5	8/5
Peak Gains: IL,EL,HW,OT: W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in³	ACH-0.4	ACH-0.4

Results:

Energy cost	0.603$/Therm,0.089$/kWh,0.000$/kW	0.603$/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	86702	136873
Energy cost, $	821	1129
Saved by daylighting, kWh	-	NA
Total Electric, kWh	4385	4474
Internal/External lights, kWh	784/86	784/86
Heating/Cooling/Fan, kWh	0/631/507	0/680/748
Hot water/Other, kWh	0/2377	0/2377
Peak Electric, kW	2.6	3.0
Fuel, hw/heat/total, kBtu	9763/61978/71740	9763/111842/121605
Emissions, CO2/SO2/NOx, lbs	14366/43/27	20375/49/34
Construction Costs	154833	156069
Life-Cycle Cost	182803	192566

Energy-10 Summary Page Dec 02, 2003

Project: trav2000 **Project Directory:** C:\Program Files\Energy10v1_6\TRAV2000

Description:	IECC	MDEC
Scheme Number:	1 / Not Saved	2 / Not Saved
Library Name:	ARCHIVELIB	ARCHIVELIB
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:		Like IECC but:
.5 instead of		
Weather file:	Traverse.etl	Traverse.etl
Floor Area, ft²	2000.0	2000.0
Surface Area, ft²	4210.0	4210.0
Volume, ft³	17000.0	17000.0
Total Conduction UA, Btu/h-F	412.3	596.3
Average U-value, Btu/hr-ft²-F	0.098	0.142
Wall Construction	r-15, R-14.4	r-15, R-14.4
Roof Construction	attic, r-38, R-31.8	attic, r-38, R-31.8
Floor type, insulation	Basement, Reff-9.9	Basement, Reff-4.0
Window Construction	u-0.40, shgc0.40, 27.6 sqft, U-0.40,etc	u-0.50, shgc0.40, 27.6 sq
.50,etc		
Window Shading	None	None
Wall total gross area, ft²	2210	2210
Roof total gross area, ft²	1000	1000
Ground total gross area, ft²	1000	1000
Window total gross area, ft²	332	332
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.40, shgc-0.40, U-0.40	u0.50, shgc-0.40, U-0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	50/21/20	67/22/30
Rated Air Flow/MODA,cfm	1050/0	1354/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff-90,EER-8.9	eff-80,EER-8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	8/5	8/5
Peak Gains: LL,EL,PW,OT; W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in³	ACH-0.4	ACH-0.4

Results:

Energy cost	0.6038/Therm,0.0898/kWh,0.0002/kW	0.6038/Therm,0.0898/kWh,0.0002/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	146482	214725
Energy cost, $	1468	1883
Saved by daylighting, kWh	-	NA
Total Electric, kWh	8544	8602
Internal/External lights, kWh	1572/171	1572/171
Heating/Cooling/Fan, kWh	0/2192/944	0/2953/1147
Hot water/Other, kWh	0/4764	0/4764
Peak Electric, kW	4.4	4.7
Fuel, hw/heat/total, kBtu	19564/97768/117328	19564/165820/185384
Emissions, CO2/SO2/NOX, lbs	25339/80/50	33454/88/59
Construction Costs	309667	310880
Life-Cycle Cost	359031	371759

Energy-10 Summary Page Dec 02, 2003

Project: trav1629 **Project Directory:** C:\PROGRAM FILES\ENERGY10V1_6\TRAV1629

Description:	IECC	MUEC
Scheme Number:	1 / Saved	2 / Saved
Library Name:	Local Only	Local Only
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:	IECC	MUEC
Weather file:	Traverse.etl	Traverse.etl
Floor Area, ft²	1629.0	1629.0
Surface Area, ft²	3669.0	3669.0
Volume, ft³	13846.5	13846.5
Total Conduction UA, Btu/h-F	332.8	483.6
Average U-value, Btu/hr-ft²-F	0.091	0.132
Wall Construction	r-15, R-14.4	r-15, R-14.4
Roof Construction	attic, r-38, R-31.8	attic, r-38, R-31.8
Floor type, insulation	Basement, Reff-9.9	Basement, Reff-4.0
Window Construction	u-0.50, shgc0.40, 15.08 sqft, U-0.47,etc	u-0.50, shgc0.40, 15.08 sq
.47,etc		
Window Shading	None	None
Wall total gross area, ft²	1545	1545
Roof total gross area, ft²	1116	1116
Ground total gross area, ft²	1008	1008
Window total gross area, ft²	181	181
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.50, shgc-0.40, U-0.50	u0.50, shgc-0.40, U-0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	41/15/20	55/15/20
Rated Air Flow/MODA,cfm	823/0	1108/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff-90,EER-8.9	eff-80,EER-8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	8/5	8/5
Peak Gains: IL,EL,HW,OT: W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in³	ACH-0.4	ACH-0.4

Results:

Energy cost	0.603$/Therm,0.089$/kWh,0.000$/kW	0.603$/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	121062	179315
Energy cost, $	1187	1546
Saved by daylighting, kWh	-	NA
Total Electric, kWh	6674	6792
Internal/External lights, kWh	1280/140	1280/140
Heating/Cooling/Fan, kWh	0/715/658	0/554/938
Hot water/Other, kWh	0/3880	0/3880
Peak Electric, kW	3.2	3.6
Fuel, hw/heat/total, kBtu	15935/82355/98290	15935/140205/156140
Emissions, CO2/SO2/NOx, lbs	20577/64/40	27568/71/48
Construction Costs	251666	252768
Life-Cycle Cost	291323	302284

Energy-10 Summary Page Dec 02, 2003
Project: trav998 **Project Directory:** C:\PROGRAM FILES\ENERGY10V1_6\TRAV998

Description:	1 IECC	2 MUEC
Scheme Number:	1 / Not Saved	2 / Not Saved
Library Name:	Local Only	Local Only
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:	IECC	MUEC
Weather file:	Traverse.etl	Traverse.etl
Floor Area, ft²	998.0	998.0
Surface Area, ft²	3118.0	3118.0
Volume, ft³	8483.0	8483.0
Total Conduction UA, Btu/h-F	278.5	444.9
Average U-value, Btu/hr-ft²-F	0.089	0.143
Wall Construction	r-15, R=14.4	r-15, R=14.4
Roof Construction	attic, r-38, R=31.8	attic, r-38, R=31.8
Floor type, insulation	Basement, Reff=9.8	Basement, Reff=4.0
Window Construction	u-0.40, shgc0.40, 13 sqft, U-0,etc	U-0.40,etc u-0.50, shgc0.40, 13 sqft, U-
Window Shading	None	None
Wall total gross area, ft²	1122	1122
Roof total gross area, ft²	998	998
Ground total gross area, ft²	998	998
Window total gross area, ft²	156	156
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.40, shgc-0.40, U-0.40	u0.50, shgc-0.40, U-0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/2Cool/TCool),kBtu/h	32/11/15	47/12/16
Rated Air Flow/MOOA,cfm	644/0	954/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff=90,EER=8.9	eff=80,EER=8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	8/5	8/5
Peak Gains: IL,EL,MW,OT: W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in³	ACH=0.4	ACH=0.4

Results:

Energy cost	0.603$/Therm,0.089$/kWh,0.000$/kW	0.603$/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	90703	151509
Energy cost, $	838	1217
Saved by daylighting, kWh	-	NA
Total Electric, kWh	4259	4429
Internal/External lights, kWh	784/86	784/86
Heating/Cooling/Fan, kWh	0/492/520	0/956/827
Hot water/Other, kWh	0/2377	0/2377
Peak Electric, kW	2.4	2.7
Fuel, hw/heat/total, kBtu	9763/66409/76171	9763/126632/136395
Emissions, CO2/SO2/NOx, lbs	14719/42/27	22061/50/36
Construction Cost$	154686	155992
Life-Cycle Cost	182976	194856

Energy-10 Summary Page Dec 02, 2003
Project: SSM2000 **Project Directory:** C:\Program Files\Energy10v1_6\SSM2000

Description:	IECC	MCBC
Scheme Number:	1 / Saved	2 / Saved
Library Name:	MICHIGANLIB	MICHIGANLIB
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:	IECC	MCBC
Weather file:	Saultstm.et1	Saultstm.et1
Floor Area, ft²	2000.0	2000.0
Surface Area, ft²	4210.0	4210.0
Volume, ft³	17000.0	17000.0
Total Conduction UA, Btu/h-F	375.0	572.2
Average U-value, Btu/hr-ft²-F	0.089	0.136
Wall Construction	r-19, R-17.7	r-19, R-17.7
Roof Construction	attic, r-38, R-31.8	attic, r-38, R-31.8
Floor type, insulation	Basement, Reff-9.9	Basement, Reff-4.0
Window Construction	u-0.36, shgc0.40, 27.6 sqft, U-0.36,etc	u-0.50, shgc0.40, 27.6 sqf
.50,etc		
Window Shading	None	None
Wall total gross area, ft²	2210	2210
Roof total gross area, ft²	1000	1000
Ground total gross area, ft²	1000	1000
Window total gross area, ft²	332	332
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.36, shgc-0.40, U-0.36	u0.50, shgc-0.40, U-0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	54/16/22	74/16/21
Rated Air Flow/MOOA,cfm	1087/0	1496/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff-80,EER-8.9	eff-80,EER-8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	8/5	8/5
Peak Gains; IL,EL,HW,OT; W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in³	ACH-0.4	ACH-0.4

Results:

Energy cost	0.603$/Therm,0.089$/kWh,0.000$/kW	0.603$/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	165423	236525
Energy cost, $	1528	1969
Saved by daylighting, kWh	-	NA
Total Electric, kWh	7755	7929
Internal/External lights, kWh	1572/171	1572/171
Heating/Cooling/Fan, kWh	0/460/788	0/464/1170
Hot water/Other, kWh	0/4764	0/4764
Peak Electric, kW	3.2	3.3
Fuel, kW/heat/total, kBtu	19564/119398/138962	19564/169906/209470
Emissions, CO2/SO2/NOx, lbs	26831/77/50	35395/86/60
Construction Costs	309232	311277
Life-Cycle Cost	359697	374667

Energy-10 Summary Page Dec 02, 2003
Project: SSM1629 **Project Directory:** C:\Program Files\Energy10v1_6\SSM1629

	IECC	MOEC
Description:		
Scheme Number:	2 / Not Saved	1 / Not Saved
Library Name:	MICHIGANLIB	MICHIGANLIB
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:	IECC	MOEC
Weather file:	Saultstm.etl	Saultstm.etl
Floor Area, ft²	1629.0	1629.0
Surface Area, ft²	3669.0	3669.0
Volume, ft³	13846.5	13846.5
Total Conduction UA, Btu/h-F	302.6	471.5
Average U-value, Btu/hr-ft²-F	0.082	0.129
Wall Construction	r-19, R=17.7	r-19, R=17.7
Roof Construction	attic, r-38, R=31.8	attic, r-38, R=31.8
Floor type, insulation	Basement, Reff=9.9	Basement, Reff=4.0
Window Construction	u-0.40, shgc0.40, 15.08 sqft, O=0.40,etc	u-0.50, shgc0.40, 15.08 sq
.50,etc		
Window Shading	None	None
Wall total gross area, ft²	1545	1545
Roof total gross area, ft²	1116	1116
Ground total gross area, ft²	1008	1008
Window total gross area, ft²	181	181
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.40, shgc-0.40, O-0.40	u0.50, shgc-0.40, O-0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	44/11/14	62/10/14
Rated Air Flow/MOCA,cfm	892/0	1240/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff-80,EER-8.9	eff-80,EER-8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	0/5	0/5
Peak Gains; IL,EL,PM,OT; W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in³	ACH-0.4	ACH-0.4

Results:

Energy cost	0.6038/Therm,0.089$/kWh,0.000$/kW	0.6038/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	138293	201139
Energy cost, $	1254	1648
Saved by daylighting, kWh	-	NA
Total Electric, kWh	4140	6355
Internal/External lights, kWh	1280/140	1280/140
Heating/Cooling/Fan, kWh	0/2007660	0/13/992
Hot water/Other, kWh	0/1880	0/1880
Peak Electric, kW	2.3	2.3
Fuel, hw/heat/total, kBtu	15935/101807/117342	15935/163520/179455
Emissions, CO2/SO2/NOx, lbs	22110/61/40	29735/70/49
Construction Costs	252224	253807
Life-Cycle Cost	293238	306845

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Project: SDM998 **Project Directory:** C:\Program Files\Energy10v1_6\SDM998

Description:	/ IECC	/MUEC
Scheme Number:	1 / Not Saved	2 / Not Saved
Library Name:	Local Only	MICHIGANLIB
Simulation status, Thermal/DL	valid/NA	valid/NA
Comments:	IECC	MUEC
Weather file:	Saultstm.et1	Saultstm.et1
Floor Area, ft²	/998.0	998.0
Surface Area, ft²	3118.0	3118.0
Volume, ft³	8483.0	8483.0
Total Conduction UA, Btu/h-F	258.6	432.8
Average U-value, Btu/hr-ft²-F	0.083	0.139
Wall Construction	r-19, R=17.7	r-19, R=17.7
Roof Construction	attic, r-38, R=31.8	attic, r-38, R=31.8
Floor type, insulation	Basement, Reff=9.8	Basement, Reff=4.0
Window Construction	u=0.35, shgc0.40, 13 sqft, U=0.35,etc	u=0.50, shgc0.40, 13 sqft, U=0,etc
Window Shading	None	None
Wall total gross area, ft²	1122	1122
Roof total gross area, ft²	998	998
Ground total gross area, ft²	998	998
Window total gross area, ft²	156	156
Windows (N/E/S/W:Roof)	3/3/3/3:0	3/3/3/3:0
Glazing name	u0.35, shgc=0.40, U=0.35	u0.50, shgc=0.40, U=0.50

Operating parameters for zone 1

HVAC system	DX Cooling with Gas Furnace	DX Cooling with Gas Furnace
Rated Output (Heat/SCool/TCool),kBtu/h	35/8/11	53/8/11
Rated Air Flow/MOOA,cfm	696/0	1064/0
Heating thermostat	70.0 °F, no setback	70.0 °F, no setback
Cooling thermostat	78.0 °F, no setup	78.0 °F, no setup
Heat/cool performance	eff=80,EER=8.9	eff=80,EER=8.9
Economizer?/type	no/NA	no/NA
Duct leaks/conduction losses, total %	8/5	8/5
Peak Gains; IL,EL,HW,OT; W/ft²	0.20/0.04/0.66/0.36	0.20/0.04/0.66/0.36
Added mass?	none	none
Daylighting?	no	no
Infiltration, in²	ACH=0.4	ACH=0.4

Results:

Energy cost	0.603$/Therm,0.089$/kWh,0.000$/kW	0.603$/Therm,0.089$/kWh,0.000$/kW
Simulation dates	01-Jan to 31-Dec	01-Jan to 31-Dec
Energy use, kBtu	105876	171146
Energy cost, $	904	1316
Saved by daylighting, kWh	-	NA
Total Electric, kWh	3875	4151
Internal/External lights, kWh	784/86	784/86
Heating/Cooling/Fan, kWh	0/115/513	0/29/875
Hot water/Other, kWh	0/2377	0/2377
Peak Electric, kW	1.6	1.7
Fuel, hw/heat/total, kBtu	9763/82890/92652	9763/147217/156980
Emissions, CO2/SO2/NOx, lbs	16151/41/28	24119/50/37
Construction Costs	154473	156379
Life-Cycle Cost	184317	198268