FLORIDA SOLAR ENERGY CENTER®

Contract Report

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Abstract
The Building America Industrialized Housing Partnership's work with two industry partners, Cavalier Homes and Southern Energy Homes, in constructing and evaluating prototype interior duct systems is summarized. Issues of energy performance, comfort, DAPIA approval, manufacturability and cost is addressed. A stage gate 2 analysis addresses the current status of project showing that there are still refinements needed to the process of incorporating all of the ducts within the air and thermal boundaries of the envelope.

Executive Summary
In 2006 we began working with our manufactured housing partners, Cavalier Homes and Southern Energy Homes, on a duct system design that brings all duct work within the thermal envelope. A different prototype design was produced by each of the partners. Cavalier Homes featured high side discharge supply register that uses the interior wall cavities as a conduit that connects to the floor trunks. Southern Energy Homes took a radical departure from the standard manufacturer duct system approach. A single soffit located within the conditioned space at the marriage line provides the space to aesthetically place the duct system. Both manufacturers are working on the elimination of the crossover duct as a field installed process.

We also provided training and assistance to design the supply and return duct systems to manual D and size the heating and cooling systems to ACCA Manual J8. This is to help solve some comfort related complaints they get despite having tight ducts. This effort will also produce ductwork that has better airflow and lower noise.

The initial results of the simulation work show up to a 10% savings over conventional attic duct work construction techniques and nearly 7% savings with a conventional floor system.

Field monitoring is in the beginning stage of the Southern Energy prototype and is expected to be concluded in November 2008. Cavalier Homes has prototyped the HSD unit, and results are promising. A full scale monitoring effort is needed to assess the entire system design. That effort has not yet been scheduled.

Introduction

The overall objective of the Building America Industrialized Housing Partnership (www.baihp.org), a USDOE project, is to conduct cost shared research to accelerate the nationwide development of cost effective, production ready energy technologies that can be widely implemented by factory and site builders to achieve 30% to 50% savings in whole house energy use through a combination of energy efficiency and renewable energy measures. BAIHP will focus on factory builders (HUD code, Modular and Panelized), the housing segment not emphasized by the other BA teams. BAIHP will employ BA systems engineering principles to enhance the energy efficiency, comfort, durability, indoor air quality, insurability, affordability, marketability and construction productivity of U.S. housing.

It has been known for a long time that leaky ducts in residential attics are a major cause of excessive energy use in hot humid climates. Leaky ducts in manufactured housing can contribute to mold growth, soft drywall and comfort problems in addition to high cooling and heating energy use[i] (Moyer et al. 2001). For the last several years we have worked with all our factory builder partners and changed the traditional construction methods from taped ducts to ducts with mastic. This has resulted in excellent air tightness of ducts constructed in the factory[ii] (Chasar et al., 2004). While we have made significant strides in improving the ductwork construction in the factory there are still significant issues with the site connection of the ductwork between the two halves (crossover duct), belly penetrations and the connections with the external unit with a unitary system. These issues continue to plague some manufacturers.

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We also provided training and assistance to design the supply and return duct systems to manual D and size the heating and cooling systems to ACCA Manual J8. This is to help solve some comfort related complaints they get despite having tight ducts. This effort will also produce ductwork that has better airflow and lower noise.

Methodology

The process of design, simulation and prototype construction will provide the needed feedback as to the viability of incorporating all of the duct work within the conditioned space in manufactured housing, especially those built to Title 24 of the HUD code PART 3280--Manufactured Home Construction and Safety Standards. Energy simulation and Building America benchmarking was done using the Florida Solar Energy Center's EnergyGauge® USA software. Building loads and duct design completed using ACCA Manual J8 in Elite's RHVAC and Duct design software packages. Mock-ups of the various designs was completed to assess feasibility, performance and appearance. Finally, a prototype full scale home was built incorporating the new design. The home moved to a test site where performance is monitored.

Energy Analysis Using EnergyGauge® USA

The proposed duct system prototypes and the base case of the manufactured home are analyzed using the FSEC developed EnergyGauge® USA (Version 2.7.02) software program. This program predicts building energy consumption using the DOE2 analysis engine with a user friendly front end that develops DOE2 input files and models that are more appropriate for residential building systems[iii] (Parker, et. al, 1999).

An analytical model was developed for each of the manufactured home specifications. These models were essentially the same with differences only in the duct system location and the duct leakage values. A worst case orientation was chosen for the simulations. The base case and prototypes are similar in geometry, with Baton Rouge, LA chosen for the site location. The EnergyGauge® USA simulations for each specification and the Input Summary Sheets are detailed in the Appendix.

The models were selected by the company representative as the one that they wanted to try the prototype duct system design on. These represent a typical model that is built to the HUD Code standard (Title 24—Housing And Urban Development, Part 3280--Manufactured Home Construction And Safety Standards). The homes built by Cavalier and Southern Energy are typically retailed in the Southeastern section of the United States.

Table 1 Summary of Construction of the Existing and Prototype Specifications

Characteristic	Base Home	Base+ Home	Prototypes
Floor Insulation	R-11 (Cavalier: 2011sqft, Southern: 1732sqft		
Wall Insulation	R-11 (grade II)	R-11 (grade I)	
Ceiling Insulation	R-19 (grade II – R-6 at ducts)	R-19 (grade I)	
Roof	Dark shingle on 3:12 pitch		
Windows	Clear Double Pane, Metal Frame		
Heating System	Electric Resistance Furnace		
Cooling System	Central Air Conditioning: SEER13		
Water Heater	Electric Water Heater: 40 gallon		
Duct system location	Air handler: Interior Ducts: Cav: Floor SEH: Attic		Cav: HSD[1] SEH: Soffit
Duct Leakage	Qn = 0.06[2]	Qn = 0.03	Qn = 0.01
House infiltration	0.25 ach[3]		
Ventilation	0.10 ach[3] (Cavalier: 27 cfm Southern: 24 cfm)		

[1] Cavalier's HSD (High Side Discharge) uses existing in floor system and discharges the supply air at the ceiling level. It also includes a cross over duct connection within the floor.

[2] McIlvaine, Janet, David Beal, Neil Moyer, Dave Chasar, Subrato Chandra. Achieving Airtight Ducts in Manufactured Housing. Report No. FSEC-CR-1323-03

[3] From TITLE 24--HOUSING AND URBAN DEVELOPMENT, PART 3280--MANUFACTURED HOME CONSTRUCTION AND SAFETY STANDARDS, Sec. 3280.103 b1-2

A comparison of the energy costs alone, these prototypes do show an energy savings, 6.9% for the Cavalier design and 10.4% for the Southern Energy design (Table 2). The Base+ case simulations assume that the duct system crossover ducts are leak-free and that the vapor barrier around the duct is properly attached to prevent condensation on the inner liner and subsequent insulation degradation. Additionally, each base case makes a few other assumptions. In the Southern Energy design, it is assumed that when the duct system is located in the attic that the insulation is at a uniform level. In fact, the real world application will have significantly less insulation where the duct system is run. Cavalier's design is that of a floor system where the airflow is not blocked by furniture, carpets or other objects that may hinder the proper operation of the system. These assumptions are roughly accounted for in the Base case, where a real world house might perform.

Table 2 Summary of Comparisons of Simulated Savings

End-Use	Cavalier				Southern Energy			
	Base	Base+	HSD	Savings[1]	Base	Base+	Soffit	Savings[1]
Annual Energy Use (kWh)	18159	17154	16909	6.9%	23268	22630	20857	10.4%
Annual Energy Costs ($)	1453	1372	1352	7.0%	1861	1810	1667	10.4%
Annual CO^2 output (tons)	10.8	10.2	10.03	6.9%	13.8	13.4	12.4	10.1%
AC Energy (kWh)	3929	3572	3499	10.9%	3687	3575	3189	13.5%
Heat Energy (kWh)	4421	3774	3602	18.5%	9325	8799	7412	20.5%

[1] Savings calculated on reduction from Base case.

Duct design

The Title 24 HUD Code Sec. 3280.511 Comfort cooling certificate and information, provides three alternatives for duct system design when cooling is considered:

- *Alternate I.* If a central air conditioning system is provided by the home manufacturer, the heat gain calculation necessary to properly size the air conditioning equipment shall be in accordance with procedures outlined in chapter 22 of the 1989 ASHRAE Handbook of Fundamentals, with an assumed location and orientation.
- *Alternate 2.* Comfort Cooling Certificate. This air distribution system of this home is suitable for the installation of central air conditioning.   The supply air distribution system installed in this home is sized for Manufactured Home Central Air Conditioning System of up to _______ B.T.U./Hr. rated capacity which are certified in accordance with the appropriate Air Conditioning and Refrigeration Institute Standards. When the air circulators of such air conditioners are rated at 0.3 inch water column static pressure or greater for the cooling air delivered to the manufactured home supply air duct system. Information necessary to calculate cooling loads at various locations and orientations is provided in the special comfort cooling information provided with this manufactured home.
- *Alternate 3.* The air distribution system of this home has not been designed in anticipation of its use with a central air conditioning system.

The team members that we work with rarely supply the air conditioning system with the home. The reasons range from warranty issues to proper sizing of the unit because of not knowing where the final location will be. Thus Alternate 2 is typically chosen, the duct system is sized for x number of BTU/Hr which is typically larger than what the house will need. In the past, air conditioning systems have been sized for the house based on that number, not on a load calculation for that house in that location. This over sizing of cooling equipment has caused durability concerns (able to lower in interior temperature of the house far below ambient dewpoint conditions), comfort complaints (lack of humidity control), and energy usage (Moyer et al. 2001) .

The HUD code is only interested in how many BTUHs the duct system can handle. The code states: "*The refrigerated air cooling supply duct system including registers must be capable of handling at least 300 CFM per 10,000 BTUH with a static pressure no greater than 0.3" of water when measured at room temperature*, Part 3280.715 (a) (3) (ll)". An effort is underway to rewrite the code to provide better guidance in the design of the forced air system. Washington State University, a Building America partner, is taking the lead on this effort.

The industry uses a program called "CertiDuct" copyrighted by Nordyne. The program is a simple, but very restrictive duct calculation program - it is spreadsheet derivative. An output can be seen in Figure 1. The restrictions are:

- Only calculates 300 CFM per 10,000 BTUH with a static pressure no greater than 0.3 inwc of water
- Rectangular duct is not an option
- Common duct fittings are not an option
- Limited on the size of supply registers
- Has no bearing on heat gain calculations

The good point is that it is easy to learn. The bad point is that it does not design a system, the operator can simply enter in duct sizes until he meets the code requirement of 300 CFM per 10,000 BTUH with a static pressure no greater than 0.3 inwc of water.

In an effort to improve performance of the system, and provide better information for the installer of the air conditioning system in the field, it is believed that a tool should be used to assist in the design process (See Appendix 1). Using an ACCA (Air Conditioning Contractors of America) approved Manual J8 software program, such as Elite's Rhvac[1] or Wrightsoft's Right-J™ [2], quickly and accurately calculates the heating and cooling loads for residential and small commercial structures. Comprehensive reports include detailed loads on many levels: the building, each system, each zone, and each room. This data includes the tonnage requirements at each level as well as the CFM requirements for both heating and cooling. The program will also allow you to easily rotate the orientation of existing rooms and calculate the heating and cooling loads based on the new orientation. Automatic, accurate duct sizing is performed for each system, as well as for the run outs leading to the registers of each room. The number of registers in each room can be calculated automatically based on a desired airflow per run out, or the number of registers can be entered manually.

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[1] http://www.elitesoft.com/web/hvacr/elite_rhvacw_info.html
[2] http://www.wrightsoft.com/Products/RightSuiteUniversal/RightJ/tabid/130/Default.aspx

CertiDuct 5.0

Duct Design Input

Model ES303 **Mfg.** Southern Energy Homes **Date** 2/2/2007 **Source** Addison Plant

Design Type	Flow Direction	Plenum Connection	Plenum Location	Plenum Width X Plenum Length
Double-section	Up Flow	Furnace	N/A	N/A

Note: all the unspecified dimensions are in inches.

Duct Connection Three				Branches	Flex D	Flex L (ft)	Bend (°)	Tag	Reg. HxW
Furnace	Main Mixer			6	16	1	0	Main	N/A
		Register		1	10	1	0	Reg 1	12 X 8
		Mixer		2	9	3	0	Mixer	N/A
			Register	1	5	2	0	Reg 2	8 X 4
			Mixer	2	8	3	0	Mixer	N/A
			Register	1	7	4	90	Reg 3	12 X 6
			Register	1	5	4	90	Reg 4	8 X 4
		Cros. Mixer		1	14	7	0	Cros	N/A
			Mixer	2	10	3	0	Mixer	N/A
			Register	1	7	1	0	Reg5	12 X 6
			Register	1	7	12	135	Reg 6	12 X 6
		Mixer		1	12	6	0	Mixer	N/A
			Register	1	7	1	0	Reg 7	12 X 6
		Mixer		1	10	10	45	Mixer	N/A
			Register	1	5	1	0	Reg 8	8 X 4
		Mixer		2	10	12	0	Mixer	N/A
			Register	1	7	2	0	Reg 9	12 X 6
			Register	1	7	2	0	Reg 10	12 X 6

Duct Design Performance

The refrigerated air cooling supply duct system including registers must be capable of handling at least 300 cfm per 10,000 Btuh with a static pressure no greater than 0.3 inches of water when measured at room temperature-HUD Manufactured Home Construction and Safety Standards, Part 3280.715 (a) (3) (ii)

Performance Calculated at a Static Pressure of 0.3 in. wc.

Air Flow Rate (SCFM)	1875	Duct Capacity (Btu/Hr)	62500

 CertiDuct 5.1

Figure 1 CertiDuct Output

The HVAC sizing design criteria is based in accordance with the (ACCA) Manual J (Residential Load Calculation) and Manual D (Residential Duct Systems). Both manuals are ANSI approved and referenced in most building codes. More information can be found at www.acca.org.

The process starts with the Manual J load calculation. The room by room calculation estimates the sensible loss for winter heating and sensible & latent gain for summer cooling. Manufactured homes are not the leaky tin boxes on wheels of yesteryear, the entry level manufactured home is built to higher standards than most site built homes. They use the same typical materials and assemble them in a dry plant atmosphere. The building is built very tight, insulated well, and durable enough to go down the highway with very little damage (try that with a site built home). Properly sizing the equipment is very important for comfort and durability. Figure 2 shows a summary of materials used in the calculations, the areas, sensible losses and gains and latent gain. There are people and internal loads also, but no duct loads because the duct is in the conditioned space.

The room by room method calculates the BTUH for each room. Figure 3 is a summary of those loads. The required CFM for each room is based on the required BTUH for each room. The duct design cannot be started until we get to this point. The calculation calls for 1.73 tons, but recommends 1.98 tons because the house has an 86% sensible heat ratio (SHR) and most equipment has a 75% SHR output. Not knowing what orientation the house would face for this calculation, the front door was chosen to face the north. In order to find worst case scenario, a rotation calculation was performed. Figure 4 shows that the home peaks out with front door facing west. The recommended tonnage facing west is 2.54, considering this we decided to design for 1200 CFM which will handle up to 3-tons of cooling and 91,000+ BTUs of heating. Now we can adjust the CFM to the fan output of 1200. Increasing the CFM to each room so that the total will be 1200. Figure 3, the last two columns show the Clg Nom CFM which is based on the sensible load and the Air Sys CFM which is based on the fan output CFM we selected.

The duct calculation starts out by drawing a stick design on scaled blueprint. The lines will go from fan to diffusers with the room CFM written at each diffuser. Then trunk lines and run-out lengths are entered in the program along with fittings, diffuser size and room CFM. The program sizes the duct system based on Manual D procedures. The program calculates the size ducts needed to design a properly operating system.

Figure 5 is the Output Summary and it shows that the duct system including equipment and diffusers will move 1214 CFM at .256 inwc static pressure. The equipment output is based on a total overall static pressure of 0.5 inwc, this leaves 0.239 inwc of available pressure to handle such add-ons as high efficiency filters. Figure 5 is the Duct Connection Tree Diagram which shows the trunk line #, the supply run-out #, CFM, duct size, and diffuser size

Rhvac - Residential & Light Commercial HVAC Loads — Calcs-Plus, Venice, FL 34293-6060 — **Elite Software Development, Inc.** Southern Energy ES303, Page 5

Total Building Summary Loads

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
1D-cb-o: Glazing-Double pane, operable window, clear, metal frame with break, outdoor insect screen with 50% coverage, white or reflective color drapes with tight weave with 50% coverage, u-value 0.65	71.6	2,187	0	1,579	1,579
1D-cb-o: Glazing-Double pane, operable window, clear, metal frame with break, outdoor insect screen with 50% coverage, u-value 0.65	80.9	2,471	0	2,122	2,122
11J: Door-Metal - Fiberglass Core	40.2	1,134	0	772	772
12B-0sw: Wall-Frame, R-11 insulation in 2 x 4 stud cavity, no board insulation, siding finish, wood studs	1267.3	5,778	0	3,700	3,700
16B-21: Roof/Ceiling-Under attic or knee wall, Vented Attic, No Radiant Barrier, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane, R-21 insulation	1731.6	3,581	0	4,267	4,267
20P-11: Floor-Over open crawl space or garage, Passive, R-11 blanket insulation, any cover	1731.6	6,347	0	2,160	2,160
Subtotals for structure:		21,498	0	14,600	14,600
People:	4		420	980	1,400
Equipment:			1,200	1,200	2,400
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 57, Summer CFM: 47		2,915	1,247	1,082	2,329
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		24,413	2,867	17,862	20,729

Check Figures

Total Building Supply CFM:	1,200	CFM Per Square ft.:	0.693
Square ft. of Room Area:	1,732	Square ft. Per Ton:	873
Volume (ft³) of Cond. Space:	15,516	Air Turnover Rate (per hour):	4.6

Building Loads

Total Heating Required With Outside Air:	24,413 Btuh	24.413 MBH
Total Sensible Gain:	17,862 Btuh	86 %
Total Latent Gain:	2,867 Btuh	14 %
Total Cooling Required With Outside Air:	20,729 Btuh	1.73 Tons (Based On Sensible + Latent)
		1.98 Tons (Based On 75% Sensible Capacity)

Notes

Calculations are based on 8th edition of ACCA Manual J.
All computed results are estimates as building use and weather may vary.
Be sure to select a unit that meets both sensible and latent loads.

Figure 2 Total Building Summary Loads

Rhvac - Residential & Light Commercial HVAC Loads — Calcs-Plus, Venice, FL 34293-6060 — **Elite Software Development, Inc.** Southern Energy ES303, Page 17

System 1 Room Load Summary

No	Room Name	Area SF	Htg Sens Btuh	Min Htg CFM	Run Duct Size	Run Duct Vel	Clg Sens Btuh	Clg Lat Btuh	Min Clg CFM	Act Sys CFM
---Zone 1---										
1	Bedroom 2	208	3,400	45	1-7	503	2,002	211	92	134
2	Kitchen	207	2,230	29	1-7	525	2,087	999	96	140
3	Dining Room	113	1,703	22	1-5	577	1,171	61	54	79
4	Foyer	66	1,138	15	1-4	563	731	37	34	49
5	Master Bedroom	239	3,674	48	1-7	546	2,171	224	100	146
6	Master Bath	130	1,635	21	1-5	635	1,289	78	59	87
7	Master Closet	62	1,296	17	1-4	581	755	123	35	51
8	Living Room	346	4,260	56	1-10	535	4,347	456	199	292
9	Laundry	116	1,545	20	1-5	583	1,184	453	54	80
10	Bedroom 3	184	2,872	38	1-6	590	1,725	185	79	116
11	Barh 2	61	660	9	1-4	308	400	40	18	27
	System 1 total	1,732	24,413	320			17,862	2,867	819	1,200

System 1 Main Trunk Size: 20 in.
Velocity: 550 ft./min
Loss per 100 ft.: 0.111 in.wg

Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	1.73	86% / 14%	17,862	2,867	20,729
Recommended:	1.98	75% / 25%	17,862	5,954	23,816

Figure 3 Room Summary Loads

Rhvac - Residential & Light Commercial HVAC Loads — Calcs-Plus, Venice, FL 34293-6060 — **Elite Software Development, Inc.** Southern Energy ES303, Page 18

Building Rotation Report

All rotation degree values in this report are clockwise with respect to the project's original orientation.
Building orientation as entered (zero degrees rotation): Front door faces North
At least one system with its System Air Type input set to Fixed was changed to Auto during the building rotation. If you want to change this behavior uncheck the option on the General tab of the Select Reports dialog called "Always use Auto for System Air Type for Building Rotation Report."

Individual Rooms

Rm. No.	Room Name	0° Rot. CFM	45° Rot. CFM	90° Rot. CFM	135° Rot. CFM	180° Rot. CFM	225° Rot. CFM	270° Rot. CFM	315° Rot. CFM	High Duct Size
System 1:										
Zone 1:										
1	Bedroom 2	82	101	110	100	83	103	*111	101	1-6
2	Kitchen	89	107	115	105	89	108	*116	107	1-6
3	Dining Room	49	79	95	80	50	82	*96	79	1-6
4	Foyer	30	31	30	30	30	*31	30	31	1-4
5	Master Bedroom	89	108	117	107	90	110	*118	108	1-6
6	Master Bath	*54	50	40	49	54	51	41	51	1-4
7	Master Closet	31	32	31	31	31	*32	31	31	1-4
8	Living Room	184	247	276	239	181	247	*278	246	1-10
9	Laundry	50	51	50	50	50	*51	50	50	1-4
10	Bedroom 3	70	84	89	81	69	83	*89	83	1-6
11	Barh 2	16	17	16	16	16	*17	16	17	1-4

* Indicates highest CFM of all rotations.

Whole Building

Rotation Degrees	Front door Faces	Supply CFM	Sensible Gain	Latent Gain	Net Tons	Recommended Tons
0°	North	743	16,309	*3,219	1.63	1.81
45°	Northeast	906	19,881	3,219	1.92	2.21
90°	East	968	21,248	3,219	2.04	2.36
135°	Southeast	887	19,465	3,219	1.89	2.16
180°	South	743	16,302	3,219	1.63	1.81
225°	Southwest	915	20,091	3,219	1.94	2.23
270°	West	*977	*21,439	3,219	*2.05	*2.38
315°	Northwest	903	19,822	3,219	1.92	2.20

* Indicates highest value of all rotations.

Figure 4 Building Rotation Report

Ductsize - HVAC Duct Sizing — Calcs-Plus, Venice, FL 34293-6060 — **Elite Software Development, Inc.** SE303 Overhead Duct Prototype, Page 10

System 1 "System 1" - Output Summary - Supply

Number of active trunks:	8
Number of active runouts:	10
Total system weight (lb.) minus fittings:	0.00
Total outlet flow	1,214
Total outlet flow after heat gain	1,214
Size of largest trunk:	16.0
Size of smallest trunk:	8.0
Size of largest runout:	10.0
Size of smallest runout:	5.0
Maximum static pressure loss occurs in route to runout:	S6
Cumulative static pressure loss at above runout:	0.261
Isolate Return From Supply Option:	No
Return SP Loss Added to 1st Trunk of Supply:	0.000
Available static pressure at above runout:	0.239
Fan static pressure:	0.500
Fan velocity pressure:	0.048
Fan total pressure:	0.548

Figure 5 Output Supply Report

A duct layout is drawn showing the duct sizes, layout and expected flows as shown in Figure 7. Following this layout will ensure adequate airflow to each zone without excess noise and discomfort

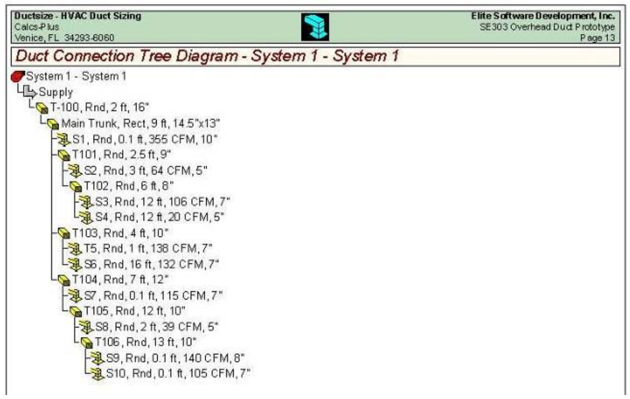

Figure 6 Output Supply Report

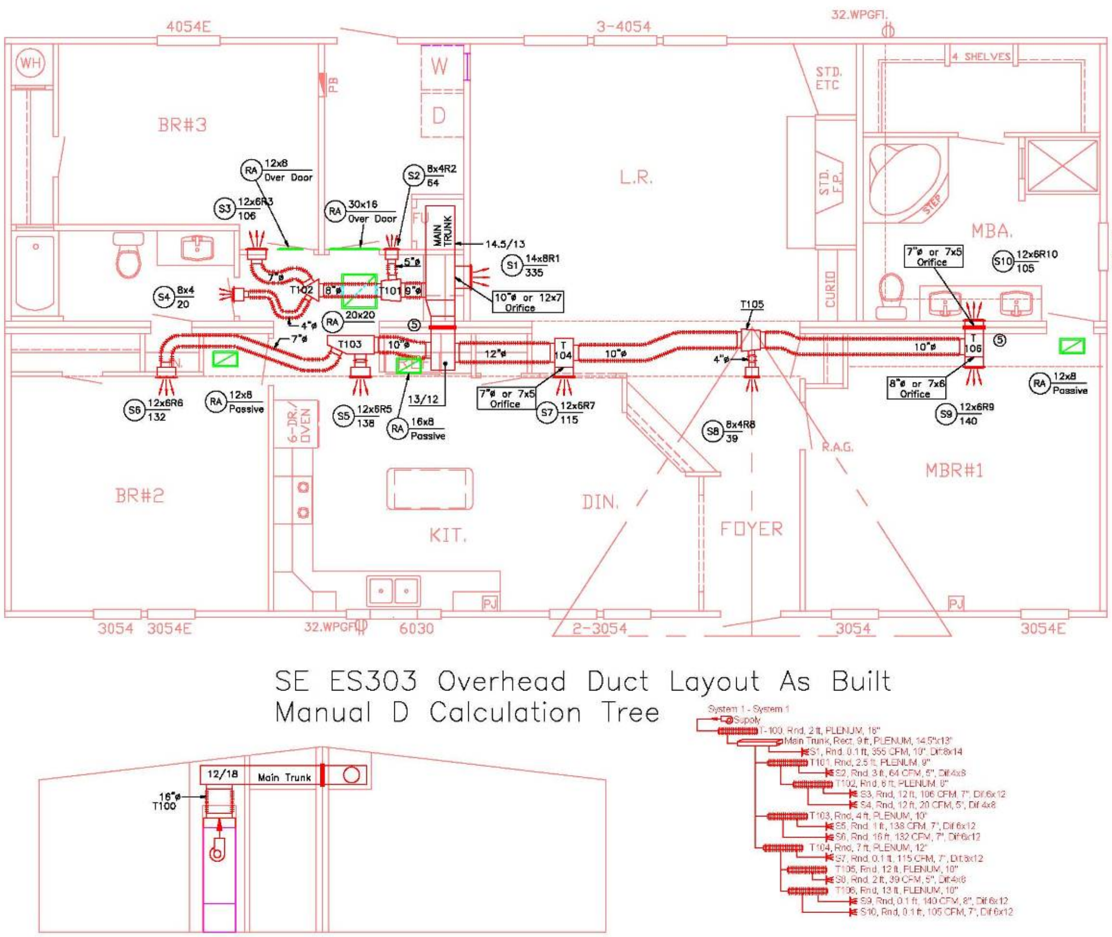

Figure 7 Duct System Layout

Building America Benchmark

Benchmark analysis was performed using the EnergyGauge USA software.

Tables 3 and 4 compare simulated annual site energy use for the Building America benchmark to the prototypes. The only difference was that of the duct system, there was assumed to be no difference in appliance and plug load usage. Electric energy savings of 18.5% and 19.8% (1.6% improvement associated with duct design) for the Cavalier home. Savings for the Southern Energy home was 15.3% and 20.2% (5.8% improvement for duct design).

Table 3 Cavalier Homes Annual Site/Source Energy (kWh)

End Use	**BA Benchmark**	**Base+**	**% Savings**	**HSD**	**% Savings**
Space Heating	8675	6348	26.8%	6094	29.8%
Space Cooling	6486	4424	31.8%	4334	33.2%
DHW	3268	2690	17.7%	2690	17.7%
Lighting	2317	2373	-2.4%	2373	-2.4%
Appliances + Plug	6118	6016	1.7%	6016	1.7%
OA Ventilation	227	227	0.0%	227	0.0%
Total Usage	27091	22078	18.5%	21734	19.8%
Site Generation	0	0		0	
Net Energy Use	27091	22078	18.5%	21734	19.8%

Table 4 Southern Energy Homes Annual Site/Source Energy (kWh)

End Use	**BA Benchmark**	**Base+**	**% Savings**	**Soffit**	**% Savings**
Space Heating	7559	6213	17.8%	5476	27.6%
Space Cooling	5655	3842	32.1%	3406	39.8%
DHW	2902	2360	18.7%	2360	18.7%
Lighting	2094	2144	-2.4%	2144	-2.4%
Appliances + Plug	5461	5460	0.0%	5460	0.0%
OA Ventilation	187	187	0.0%	187	0.0%
Total Usage	23858	20206	15.3%	19032	20.2%
Site Generation	0	0		0	
Net Energy Use	23858	20206	15.3%	19032	20.2%

Factory mockups – Duct system, crossover connections

The engineering staff of both companies desired to produce mock-ups of the new systems to show management our concepts. In the case of Southern energy, a crossover connection in the marriage wall was created and cardboard was used to show what the new marriage line soffit would look like. For Cavalier, the crossover connection through the rim joist and HSD wall were created and analyzed.

As a result of these mockups (Figures 8-11), each company has built a full scale prototype in the home. Currently the Southern Energy home being monitored. Cavalier is building in stages, the first stage was to look at field performance as related to durability issues. There was some concern on using interior wall sections as being susceptible to condensation as a result of being used as a part of the supply duct system. In January, a full scale prototype utilizing both the HSD and crossover duct will be produced.

Figure 8 Cavalier crossover mockup

Figure 9 Southern Energy crossover mockup

Figure 10 Cavalier HSD mockup

Figure 11 Southern Energy soffit mockup

Factory construction – Costs

Initial cost estimates from both companies to include these enhancements is low.   The following question was posed to the Director of Engineering of each company, “What do you think is the approximate cost difference is between current practice and HSD duct (on a per house basis)?”

Cavalier’s response, *“Depending on the design of the house, it could be as low as $100.00 per home and as high as $300.00 per home.”*

And from Southern Energy, *“This is a shot in the dark, I would guess about $200”*

Instrumentation and Monitoring

A monitoring protocol was developed for the project as shown by the detailed instrumentation see Table 1. Measurement of temperature, relative humidity and power usage of the HVAC equipment and total building is done to determine the effectiveness of the new design.

Figure 12 Thermostat w/sensor

Figure 13 Duct sensors

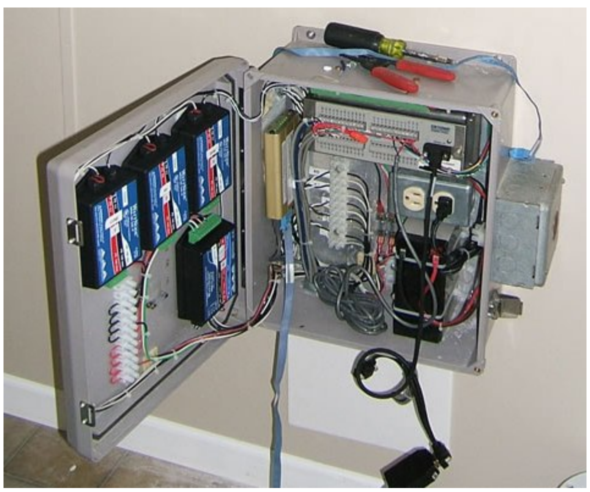

Figure 14 Datalogger with power meters

Figure 15 Ambient air sensors

To compare performance of the prototype and conventional duct systems, the collected data is used to calibrate the simulation results. All measurements were monitored on a 15-minute basis (data sampled at 15 second intervals and averaged or totaled depending on data type). Monitoring included: power use (total building, condenser and air handler), air temperature and relative humidity at the thermostat, supply plenum air temperature, air temperatures entering and leaving coil, and outdoor air temperature, relative humidity and solar radiation. The Campbell Scientific CR10x datalogger was used to collect the data from the various sensors. Power was measured with the Pulse Output WattNode® RMS AC watt-hour transducer with a pulse output (solid state relay closure) proportional to kWH consumed. Temperatures measurements were done with sensors from Vaisala (INTERCAP® Humidity and Temperature Transmitters HMD 50). A few temperature measurements were done with thermocouples, such as the shingle surface temperature and some of the temperature only duct measurements.

In addition to the above, temperature and relative humidity measurements were done in various locations of the Cavalier Homes HSD duct system to determine sensitivity to moisture.

Monitoring was designed to include a minimum of three months of summer conditions and a maximum of 12 months. The Cavalier home data collection began on December 21, 2006 and concluded on October 12, 2007. The Southern Energy home collection started on November 07, 2007 and is expected to continue through November 2008.

Figure 16 Cavalier HSD prototype home located in Opelousas, LA

Figure 17 Southern Energy Soffit prototype located in Double Springs, AL

Table 5 Monitored and Collected Data

Cavalier HSD	Southern Energy Soffit
BATTERY VOLTAGE (v)	
THERMOSTAT TEMP (F)	
THERMOSTAT RH (%)	
SUPPLY PLENUM TEMP (F)	
SUPPLY PLENUM RH (%)	
OUTDOOR AIR INLET TEMP (F)	
BUILDING POWER (WATTHRS)	
AIR HANDLER/HT PWR (WATTHRS)	
COMPRESSOR POWER (WATTHRS)	
MASTER BDRM DUCT-WALL TEMP (F)	AMBIENT (RH)
MASTER BDRM DUCT-WALL RH (%)	MASTER BDRM TEMP (F)
DINING ROOM INTERIOR DUCT AIR TEMP (F)	MASTER BDRM (RH)
MASTER BATH DUCT-WALL TEMP (F)	CRAWL SPACE TEMP (F)
NW BDRM DUCT-WALL TEMP (F)	CRAWL SPACE (RH)
SW BDRM DUCT-WALL TEMP (F)	SHINGLE SURF TEMP (F)
RETURN TEMP (F)	DHW POWER (WATTHRS)

Results

"SNAPSHOT" Building Evaluation [**S**hort **N**ondestructive **A**pproach **P**roviding **S**ignificant **H**ouse **O**perating **T**hresholds][3] is a procedure developed by Building Science Corporation. It is a technique of building evaluation will provide necessary information to quantify the building envelope performance and its interaction with the micro climate (interior) and the mezzo climate (exterior). SNAPSHOT is a series

[3] http://www.buildingscience.com/bsc/buildingamerica/snapshot_instructions.pdf

of short-term data collection techniques which follow specific protocols to characterize the building and predict long term energy performance.

Table 6 'SNAPSHOT' Results		
Description	**Cavalier HSD**	**Southern Energy Soffit**
Building Airtightness (CFM50)	2142	1797
ACH50	7.99	6.95
C – n – r ($Q=C\Delta P^n$)	C=169.5, n=0.65, r=0.998	C=157.8, n=0.62, r=0.999
EqLA@10 (sqin)	221.8	194.1
Duct Leakage Total ($CFM25_{total}$)	298	-not measured
Duct Leakage Out ($CFM25_{out}$)	65	0.0[1]
Qn ($CFM25_{out}$/floor area)	0.03	0.00

[1] Leakage below what instruments can measure.

Supply Distribution

One of the concerns of the floor duct system with its registers on the floor is that of adequate air flow, especially with furniture placement. The supply register is located near the ceiling and therefore will not be affected by furniture placement.

To verify the airflow pattern, a visualization technique was used to observe the air flow. A regular fiberglass insect window screen was attached to a temporary PVC frame and placed in the airstream of the living room supply. An infrared imaging camera was used to detect the temperature differences on the insect screen – thus visualizing the air flow pattern.

Figure 19 Insect screen normal to register

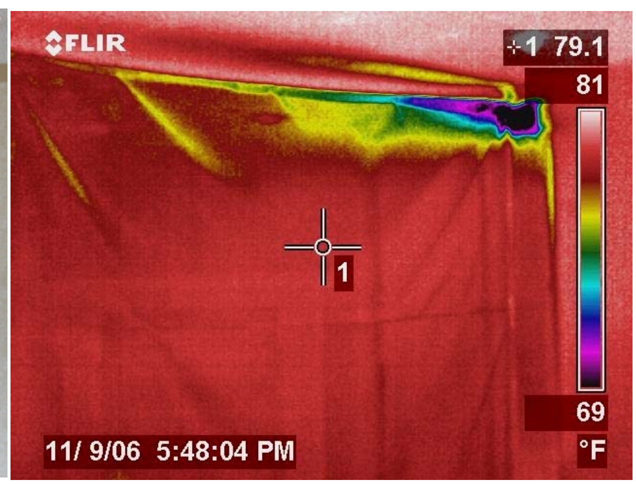

Figure 18 Thermal image of "air flow"

The creation of the HSD went through a few variations to come up with design that would allow adequate airflow and ease of construction. A mock-up was created and tested for airflows, which was shown to be equal to the current design in use. The design was then taken to the factory where various types of materials and insulations were used. The primary concern was that of condensation on the painted drywall. From a manufacturing point of view, the fewer the parts and pieces, the easier and faster the production. And from a durability perspective, it was desirous to have as much structure and insulation as possible. Therefore the monitoring process would need to look at temperatures at a few critical points to determine whether or not the drywall would be in danger of moisture damage as a result of the operation of the air conditioning system.

Cavalier Data Analysis

As previously mentioned, data was collected on 15 minute intervals. The primary concern on this data set was whether or not the interior drywall would suffer from moisture damage. The prototype house was used as a model on a dealer's lot. The owner was asked to leave the thermostat set in the mid 70's. However, the various sales staff continually adjusted the thermostat. As it turns out, this was a very good test of the system to see if there may be moisture issues. The data clearly shows that the interior dewpoint temperature is always below the supply plenum temperature (Figure 20). Thus, condensation cannot occur (and none was detected when inspected).

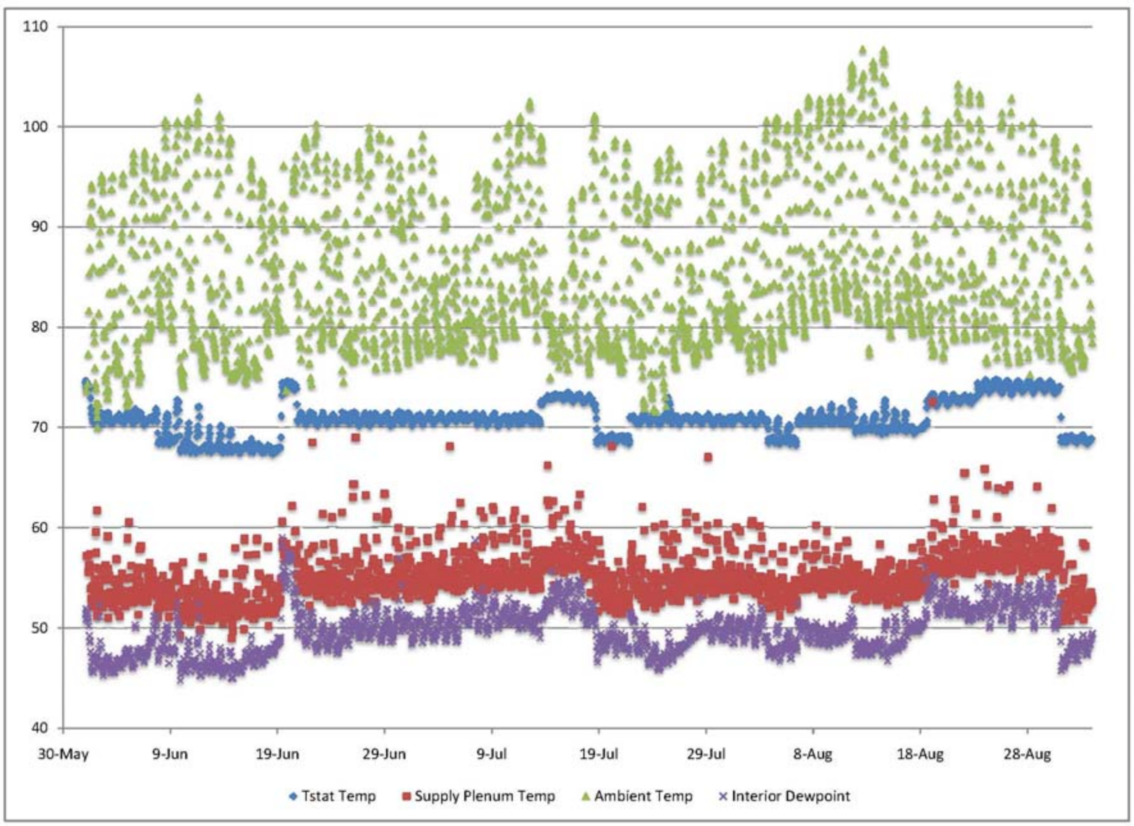

Figure 20 HSD prototype temperatures and dewpoint conditions on an hourly average 6/1 to 9/2/07

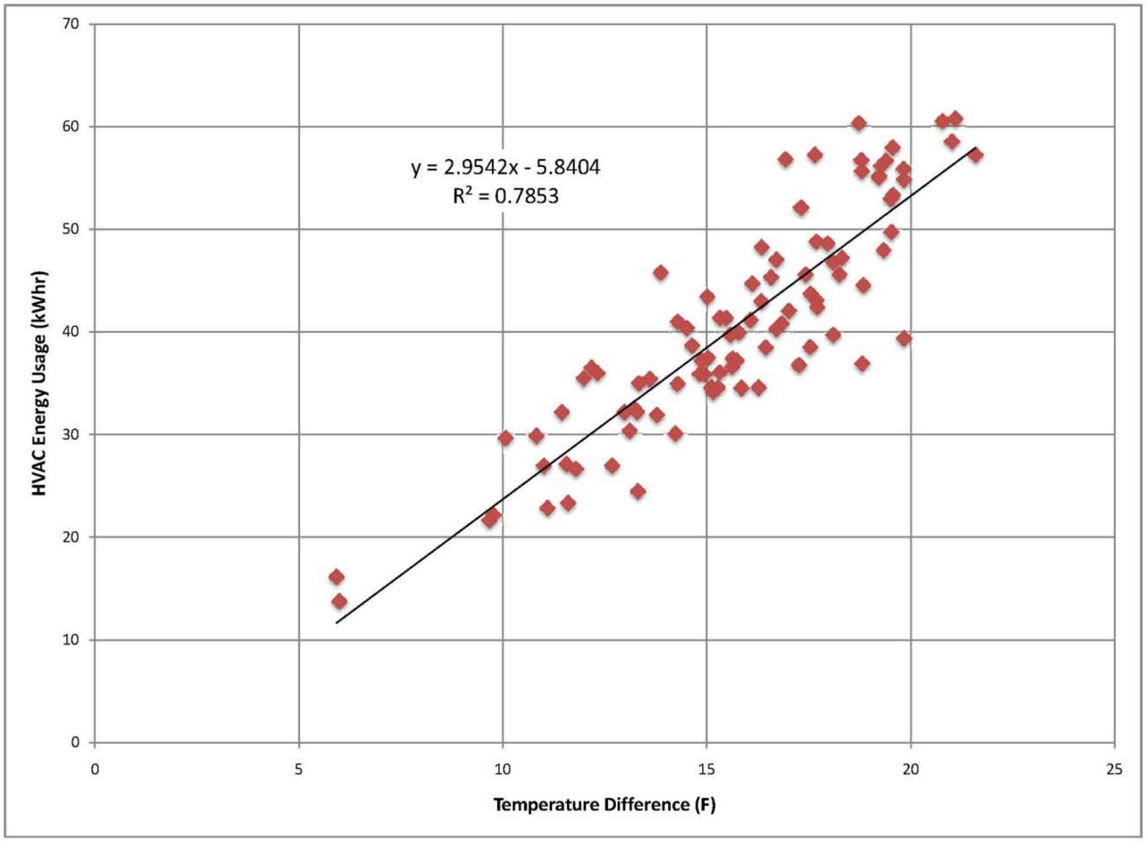

Figure 21 HSD daily energy usage verses average daily temperature difference across envelope.

Looking at a 24 hour daily profile for that period (June 1st through September 2nd), it can be seen that the interior temperature was about 71ºF with a relative humidity of 47% and a dewpoint of 49.7ºF. The ambient air averaged 88ºF. Note that the duct temperatures vary slightly. This has to do with the location of the sensors and with the fact that this is averaged data, though temperatures and humidity readings related to the duct are averaged only when the air handler operated. The master bath duct temperature is the only sensor in the supply air stream (besides the supply plenum temperature sensor). All other sensors were located just behind the drywall.

The energy usage plot is somewhat offset to the higher side from what might be a normally occupied home. The typical daily ambient to interior temperature difference on a peak summer day would be around 7ºF for that area of the country (a range from the low 70's to the mid 90's – TMY data Baton Rouge, LA). The EnergyGauge USA® simulation for a peak summer day shows an HVAC usage of 29.3 kWh. That is with an average daily ambient temperature of 85ºF and an interior temperature of 78ºF.

Southern Energy Data Analysis

Little data has been collected on the Southern Energy prototype duct house. The logger is in place and a data stream is coming in. We have noticed that it appears that the heat pump is not operating correctly. The supply plenum temperature is usually in the low 80's while heating. Also, it appears that the electric strip heating operates quite often. Note the spikes in the supply temperature (Figure 22), the operation of the heat strips seems to occur when ambient temperature is below about 40ºF, yet does not always come on at the lower temperatures.

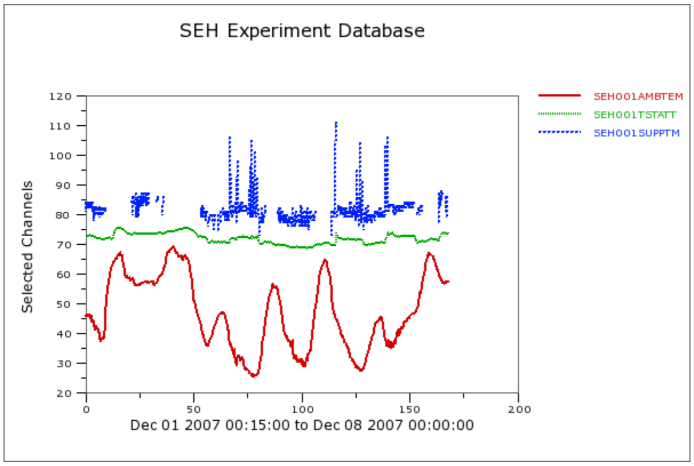

Figure 22 Southern Energy Temperatures: supply, thermostat and ambient

A factory heat pump technician is schedule to commission the system in January 2008. This will verify that the system is operating to factory specifications.

Discussion

The advantages of sealing the air distribution system has many benefits and has been proved by others.[4] The task of moving all of the duct work within the air and thermal boundaries is a challenge in the factory environment. The movement of the floors down the assembly line means that the various parts and pieces must fit into the time frame allotted. The task of how to incorporate an interior duct system would be expedited if there were a perceived benefit by the manufacturer. To that end, the following questions were posed to the engineering directors at each company.

1. What do you see as the benefit(s) to the HSD or soffit duct design?

   Cavalier: *Initial testing has revealed that High Side Discharge enhances the overall CFM of conventional in-floor duct systems and provides optimal placement of registers for air distribution, while at the same time eliminates concerns of furniture placement that often plagues in-floor designs.*

   Southern: *The obvious benefits are: no heat gain or loss on duct work, as we designed it, no site work to complete the duct system, duct leakage while certainly not desirable - has not affect on the home's interior pressures*

2. What is the biggest drawback?

   Cavalier: *Any repairs result in the sheetrock having to be removed by destruction. Replacement is not expensive from a material standpoint, but is time consuming.* And do you see it as show stopper? *Personally, yes*

   Southern: *Fabrication and installation in a concern on a production level. Conventional in attic duct personnel are not in the way of workers inside the home, while this soffit design causes duct work to be completed while other personnel are working.*

3. Do you see any market advantages and/or barriers to the new design?

[4]McIlvaine, Janet, David Beal, Neil Moyer, Dave Chasar, Subrato Chandra. Achieving Airtight Ducts in Manufactured Housing. Report No. FSEC-CR-1323-03.
Withers, C., Chasar, D., Moyer, N., and Chandra, S. "Performance and Impact from Duct Repair and Ventilation Modifications of Two Newly Constructed Manufactured Houses Located in a Hot and Humid Climate", Thirteenth Symposium on Improving Building Systems in Hot and Humid Climates, May 20-22, 2002 Houston, Texas.

Cavalier: *Advantages speak for themselves. Barriers are primarily the lack of consumers and retailers to recognize potential in something new.*

Southern: *Advantages - if marketed properly could make "Energy Star" a breeze. Barriers - some floor plans are not a conducive for this design*

4. Your comments on the new crossover design?

   Cavalier: *Looking forward to having a cross-over that is not located underneath the home, which will be a first for us. Historically the cross-over has been exposed to weather conditions and potential damage from rodents/domestic animals. A cross-over that is located inside the floor will not be subject to such potential detrimental issues.*

   Southern: *As mentioned, this eliminates on-site errors and omissions. It also keeps the crossover in a conditioned space where there is not concern about its longevity*

5. Would you be willing to produce another dozen or so homes to work out any defects in the process?

   Cavalier: *Yes*

   Southern: *I am. I hope SEHomes is willing to give it another try too*

6. Are you planning on incorporating any or all the new design into future buildings?

   Cavalier: *Yes, absolutely.*

   Southern: *At this time, there is not movement in that direction.*

7. Would you be willing to share any or all of your knowledge gained in this effort with the rest of the industry?

   Cavalier: *Due to the competitive nature of our business, it would be unlikely.*

   Southern: *I would like to keep it for myself if we decide to act on it, if we do not act on it, I think someone should benefit from our experience.*

Future Work Planned FY08

2008 should see the next stage of development of the interior duct system in manufactured housing. Both partners have provided input that there is a desire to move forward in this endeavor. Currently, the following tasks are either in progress or are to be given strong consideration.

- Monitoring of the Southern Energy Homes prototype will continue through November. This will provide a full year of data on the system as it operates through the various seasons. The heat pump is to be commissioned by a factory representative in January.
- Southern Energy's Texas plant has expressed interest in incorporating the soffit design in one of their models and to produce a number of them (10 or so) to work out the details of construction on the factory line.
- Cavalier Homes plans on building a complete prototype of the HSD with crossover in January. If this proves successful, plans are to produce additional units.
- DAPIA approval of the use of the Manual J and Manual D has been verbally given. The task remains to provide documentation and get the written approval.
- The MHLab soffit duct will be finished and monitoring of the energy usage will begin as the attic duct and soffit duct are monitored in a flip-flop fashion.

- In general, the interior duct design, including crossover duct for multi-section units will continue to be improved – especially in the factory acceptability.

Conclusions

Working with factory built housing manufacturers is a challenge. Generally, their homes are created for a lower income first time homeowner. This means that the profit margins are less with fewer opportunities for expensive innovations, especially those related to energy. The average cost of a 1750 sqft manufactured home cost about $41 per sqft compared to an average site built home of 2450 sqft which ran about $92 per sqft.[5] Shipments of manufactured homes is in a decline, from 146,800 in 2005 to 117,400 in 2006, further adding to a tighter profit margin.

There is good news, energy prices are increasing. This is causing the manufacturers to reconsider the energy usage of their buildings and trying to find that perfect niche that will find favor in the retail market. In that vein, the interior ductwork has an opportunity. It is slightly more expensive in the manufacturing process, but offers long term energy savings. Also, moving the duct work within the conditioned space will increase the life of the duct by protecting it from the harsh environment that it would otherwise be located in.

StageGate 2

Verification Method: The BP2 work with two industry partners Cavalier Homes and Southern Energy Homes in constructing and evaluating prototype interior duct systems were summarized in this report. Issues of Energy performance, comfort, DAPIA approval, manufacturability and cost were addressed. A complete stage gate 2 analysis was completed. The stage gate analysis covered all of the stage 2 criteria listed below:

Must Meet criteria

Source Energy Savings: new system must provide demonstrated energy and whole building performance benefits relative to current system solutions based on BA test and analysis results.

- Both systems perform better than the BA benchmark. The duct test of the Southern Energy home had no leakage to the exterior, and the Cavalier home had a Qn = 0.03 (and the crossover piece was of standard practice-not the new design).

Performance-Based Code Approval: must meet performance-based safety, health, and building code requirements for use in new homes.

- The materials used in both cases has met the standards for code approval. The use of the ACCA manual J8 and manual D for determine the HVAC needs of the home are in final stages of approval. Currently a verbal approval has been given by one of the DAPIAs.

Should Meet criteria

Prescriptive-Based Code Approval: should meet prescriptive safety, health and building code requirements for use in new homes

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[5] U.S. Department of Commerce, Bureau of Census 2006 data

- Materials used have met the code approval (materials are currently used in the construction of ducts and crossovers).

Cost Advantage: should provide demonstrated cost benefits relative to current systems within a whole building context

- The costs have not yet worked out. There are estimates by both Cavalier and Southern Energy that the costs should be fairly low, less than a few hundred dollars per home. The hard costs have not yet been determined, including whether or not a markup can be added to the home.

Reliability Advantage: should meet reliability, durability, ease of operation, and net added value requirements for use in new homes

- Not yet determined.

Manufacturer/Supplier Commitment: should have sufficient logistical support (warranty, supply, installation, maintenance support) to be used in prototype homes

- There is commitment to the extent of moving forward in further development of the interior duct. Factory runs need to be completed and the homes need to be set in the field to determine reliability issues – especially that of the new crossover designs.

Gaps Analysis and Case Studies: should include systems gaps analysis, lessons learned, and evaluation of major technical and market barriers to achieving the targeted performance level.

- Gaps analysis-
    - There is a gap between marketing and engineering. Marketing tends to lean toward the old days and ways. Sell the units to dealers, little effort in assisting the dealers in selling the product.
- Case studies-
    - A full scale prototype has not yet had a the time in field to determine the strengths and weaknesses of the system.
- Major technical barrier-
    - The factory process. Each company has run only one house. It was awkward at best. A production run is scheduled in Cavalier for a single house in January 2008. Southern Energy has verbal commitment from their Texas plant to consider building up to 10 or so of the soffit duct design.
    - Monitoring in a side by side comparison of old and new duct designs without human occupancy is difficult to do and may not be possible. Therefore, if a comparison is done, it will most likely be with a human component.

Appendices

Appendix 1 Trip Report: HUD acceptance of ACCA Manual J & D

TRIP REPORT

TITLE

HUD Acceptance of ACCA Manual J and Manual D

TRIP DATE

12-13-07

ATTENDEES

Neil Moyer (BAIHP/Florida Solar Energy Center), Dennis Stroer (BAIHP/Calcs-Plus), Dave Tompos (NTA), Michael Wade (Cavalier Home Builders), Chris __ (Cavalier Home Builders), and Jim Bauer (Southern Energy Homes)

TRIP REPORT DISTRIBUTION LIST (sent via email)

S. Chandra, N. Moyer, D. Tompos, M. Wade, and J Bauer

PURPOSE

For HUD to accept ACCA Manual J version 8 calculations, ACCA Manual D calculations, and ACCA approved software for those calculations.

BACKGROUND

At this time the HUD code does not recognize any particular HVAC load calculation methods. It does site ASHREA Handbook of Fundamentals 1989 -

"*(a) Information, values and data necessary for heat loss and heat gain determinations shall be taken from the 1989 ASHRAE Handbook of Fundamentals, chapters 20 through 27. The following portions of those chapters are not applicable:*

21.1 Steel Frame Construction

21.2 Masonry Construction

21.3 Floor Systems

21.14 Pipes

21.16 Tanks, Vessels and Equipment

21.17 Refrigerated Rooms and Buildings

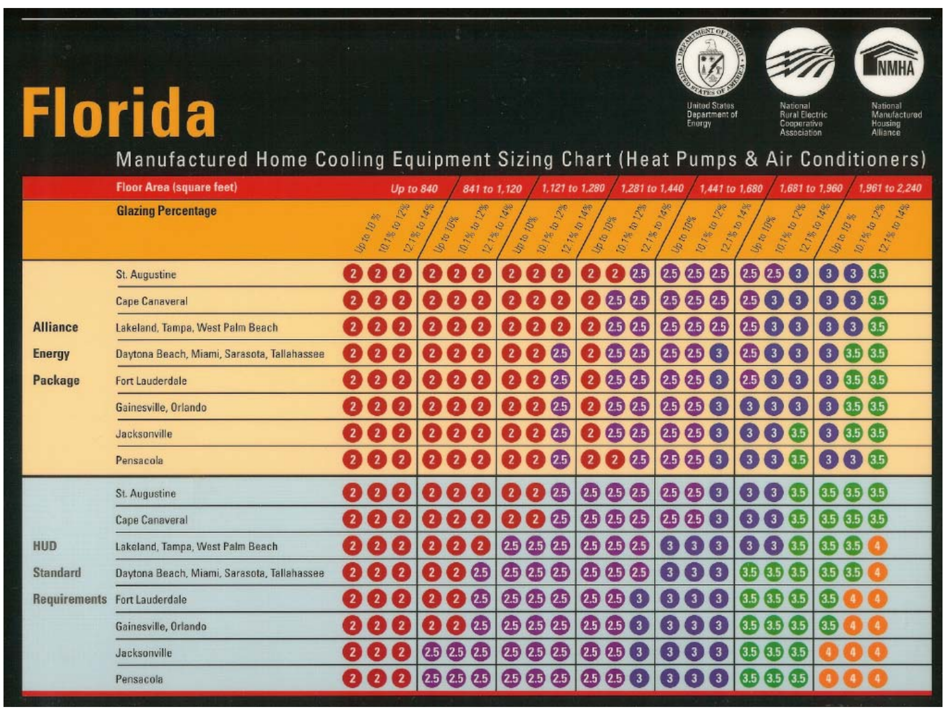
22.15 Mechanical and Industrial Systems

23.13 Commercial Building Envelope Leakage

25.4 Calculation of Heat Loss from Crawl Spaces

(b) The calculation of the manufactured home's transmission heat loss coefficient

(Uo) shall be in accordance with the fundamental principals of the 1989 ASHRAE Handbook of Fundamentals and, at a minimum, shall address all the heat loss or heat gain considerations in a manner consistent with the calculation procedures provided in the document Overall U-values and Heating/Cooling Loads- Manufactured Homes—February 1992–PNL 8006, HUD User No. 0005945."



	Floor Area (square feet)	Up to 840			841 to 1,120			1,121 to 1,280			1,281 to 1,440			1,441 to 1,680			1,681 to 1,960			1,961 to 2,240		
	Glazing Percentage	Up to 10 %	10.1% to 12%	12.1% to 14%	Up to 10%	10.1% to 12%	12.1% to 14%	Up to 10%	10.1% to 12%	12.1% to 14%	Up to 10%	10.1% to 12%	12.1% to 14%	Up to 10%	10.1% to 12%	12.1% to 14%	Up to 10%	10.1% to 12%	12.1% to 14%	Up to 10 %	10.1% to 12%	12.1% to 14%
Alliance Energy Package	St. Augustine	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3.5
	Cape Canaveral	2	2	2	2	2	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3.5
	Lakeland, Tampa, West Palm Beach	2	2	2	2	2	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3.5
	Daytona Beach, Miami, Sarasota, Tallahassee	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	2.5	2.5	3	2.5	3	3	3	3.5	3.5
	Fort Lauderdale	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	2.5	2.5	3	2.5	3	3	3	3.5	3.5
	Gainesville, Orlando	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	2.5	2.5	3	3	3	3	3	3.5	3.5
	Jacksonville	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	2.5	2.5	3	3	3	3.5	3	3.5	3.5
	Pensacola	2	2	2	2	2	2	2	2	2.5	2	2	2.5	2.5	2.5	3	3	3	3.5	3	3	3.5
HUD Standard Requirements	St. Augustine	2	2	2	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3.5	3.5	3.5	3.5
	Cape Canaveral	2	2	2	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3.5	3.5	3.5	3.5
	Lakeland, Tampa, West Palm Beach	2	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3	3.5	3.5	3.5	4
	Daytona Beach, Miami, Sarasota, Tallahassee	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3.5	3.5	3.5	3.5	3.5	4
	Fort Lauderdale	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3.5	3.5	3.5	3.5	4	4
	Gainesville, Orlando	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3.5	3.5	3.5	3.5	4	4
	Jacksonville	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3.5	3.5	3.5	4	4	4
	Pensacola	2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3.5	3.5	3.5	4	4	4

The only procedure I have seen is the one below which is nothing more

than a close guess. This procedure may have worked in the past but the envelope of manufactured homes of today are as tight as any site built home. Time has proved that over sizing the AC equipment in these homes will has disastrous affects when it comes to condensation issues.

Accepted duct sizing procedures in the manufactured home industry are also non existent. From what I see the HUD accepted program called CertiDuct which calculates the amount of air that is able to flow through a given duct system. From whit can see the program does not size ducts;

it only calculates the airflow and BTU/H based on 300 CFM of airflow per 10,000 BTU/H of cooling.

The procedure is a little backwards. A duct system is drawn based on the calculation above (?) the duct sizes are based on what ever will fit in the duct zone. After the duct sizing is laid out then it is entered into the CertiDuct program to find out how large of a cooling unit the duct system can handle. The results of the CertiDuct duct program become part of the mfg home when it is moved to its location.

CertiDuct 5.0

Duct Design Input

Model	ES303	Mfg.	Southern Energy Homes	Date	2/2/2007	Source	Addison Plant

Design Type	Flow Direction	Plenum Connection	Plenum Location	Plenum Width X Plenum Length
Double-section	Up Flow	Furnace	N/A	N/A

Note: all the unspecified dimensions are in inches.

Duct Connection Three					Branches	Flex D	Flex L (ft)	Bend (°)	Tag	Reg. HxW
Furnace	Main Mixer				6	16	1	0	Main	N/A
		Register			1	10	1	0	Reg 1	12 X 8
		Mixer			2	9	3	0	Mixer	N/A
			Register		1	5	2	0	Reg 2	8 X 4
			Mixer		2	8	3	0	Mixer	N/A
				Register	1	7	4	90	Reg 3	12 X 6
				Register	1	5	4	90	Reg 4	8 X 4
		Cros. Mixer			1	14	7	0	Cros	N/A
			Mixer		2	10	3	0	Mixer	N/A
				Register	1	7	1	0	Reg5	12 X 6
				Register	1	7	12	135	Reg 6	12 X 6
		Mixer			1	12	6	0	Mixer	N/A
			Register		1	7	1	0	Reg 7	12 X 6
		Mixer			1	10	10	45	Mixer	N/A
			Register		1	5	1	0	Reg 8	8 X 4
		Mixer			2	10	12	0	Mixer	N/A
			Register		1	7	2	0	Reg 9	12 X 6
			Register		1	7	2	0	Reg 10	12 X 6

Duct Design Performance

The refrigerated air cooling supply duct system including registers must be capable of handling at least 300 cfm per 10,000 Btuh with a static pressure no greater than 0.3 inches of water when measured at room temperature-HUD Manufactured Home Construction and Safety Standards, Part 3280.715 (a) (3) (ii)

Performance Calculated at a Static Pressure of 0.3 in. wc.

Air Flow Rate (SCFM)	1875	Duct Capacity (Btu/Hr)	62500

 CertiDuct 5.1

When the home arrives at its final destination and AC is going to be added the AC contractor looks at the CertiDuct results and assumes that the BTU/H the duct system can handle is the system size without consulting an approved HVAC sizing procedure. The mfg home could have a 3-ton load on a design day but if the CertiDuct calculation says 62,500 BTU/H as the one above does then it will get a 5-ton system.

MEETING MINUTES

These issues were discussed and admitted to during our December 13th meeting. Mr. Tompos told us that he felt that HUD would accept ACCA Manual J and Manual D with some certain requirements.

- Manual J must use the heat transfer multipliers (HTMs) that have already been established by the mfg home industry and accepted by HUD.
- Provide an MJ8 hand calculation and electronic calculation of the same building and show results.
- Provide a way to address HUDs required “Duct Capacity Calculation” based on 300 CFM per 10,000 BTU/H.

We are not looking to replace existing procedures; we would just like to have the Manual J and Manual D procedures accepted by HUD.

Building Input Summary Report

PROJECT

Title:	Southern Energy E6303 - std			Adress Type:	Street Address
Building Type:	User	New/Existing:	New (From Plans)	Lot #	
Owner:	BAIHP / Southern Energy Ho	Bedrooms:	3	SubDivision:	
# of Units:	1	Bathrooms:	2	PlatBook:	
Builder Name:		Conditioned Area:	1732	Street:	
Permit Office:		Total Stories:	1	County:	
Jurisdiction:		Worst Case:	No	City, State, Zip:	,
Family Type:	Single-family	Rotate Angle:	45		,
Comment:	STD construction				

CLIMATE

Design Location	Tmy Site	Design Temp 97.5 %	Design Temp 2.5 %	Int Design Temp Winter	Int Design Temp Summer	Heating Degree Days	Design Moisture	Daily Temp Range
LA, Baton Rouge	LA_BATONROUGE	29	93	70	75	1670	51	Medium

UTILITY RATES

Fuel	Unit	Utility Name	Monthly Fixed Cost	$/Unit
Electricity	kWh	Louisiana Average	0	0.08
Natural Gas	Therm	Louisiana Average	0	1.09
Fuel Oil	Gallon	Louisiana Default	0	1.1
Propane	Gallon	Louisiana Default	0	1.4

SURROUNDINGS

Ornt	Type	Shade Trees Height	Width	Distance	Exist	Adjacent Buildings Height	Width	Distance
N	None	ft	ft	ft		ft	ft	0 ft
NE	None	ft	ft	ft		ft	ft	0 ft
E	None	ft	ft	ft		ft	ft	0 ft
SE	None	ft	ft	ft		ft	ft	0 ft
S	None	ft	ft	ft		ft	ft	0 ft
SW	None	ft	ft	ft		ft	ft	0 ft
W	None	ft	ft	ft		ft	ft	0 ft
NW	None	ft	ft	ft		ft	ft	0 ft

FLOORS

#	Floor Type	Exposed Perimeter	Wall Ins. R-Value	Area	Floor Joist R-Value	Tile	Wood	Carpet
1	Crawlspace	177 ft	0	1732 ft²	11	0	0.25	0.75

ROOF

#	Roof Type	Materials	Attic Type	Attic Area	Roof Color	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1in)	Pitch
1	Gable or shed	Composition shingles	Full attic	1732 ft²	Dark	0.96	N	0	300	14 deg

CEILING

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	19	1620 ft²	0.11	Wood
2	Under Attic	6	112 ft²	0.11	Wood

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Building Input Summary Report

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	Width Ft	Width In	Height Ft	Height In	Area	Framing Fraction	Solar Absor.
1	N	Exterior	Frame - Wood	11	57.8	0	8	0	462.4 ft²	0.23	0.8
2	E	Exterior	Frame - Wood	11	15.1	0	9	0	135.9 ft²	0.23	0.8
3	W	Exterior	Frame - Wood	11	25.2	0	9	0	226.8 ft²	0.23	0.8
4	W	Exterior	Frame - Wood	11	4.8	0	8.4	0	40.32 ft²	0.23	0.8
5	S	Exterior	Frame - Wood	11	57.7	0	8	0	461.6 ft²	0.23	0.8
6	E	Exterior	Frame - Wood	11	9.8	0	8.75	0	85.75 ft²	0.23	0.8
7	E	Exterior	Frame - Wood	11	5.1	0	9.25	0	47.17 ft²	0.23	0.8

DOORS

#	Ornt	Door Type	Storms	U-Value	Width Ft	Width In	Height Ft	Height In	Area
1		Insulated	None	0.6	3	0	6.7	0	20.1 ft²
2		Insulated	None	0.6	3	0	6.7	0	20.1 ft²

WINDOWS

#	Ornt	Frame	Panes	NFRC	U-Factor	SHGC	Storm	Area	Overhang Depth	Overhang Separation	Interior Shade	Screening
1		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
2		TIM	Double (Clear)	Yes	0.65	0.67	N	12.5 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
3		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	1 ft 0 in	2 ft 0 in	None	Exterior 50%
4		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
5		TIM	Double (Clear)	Yes	0.65	0.67	N	11.25 ft²	0.75 ft 0 i	2.5 ft 0 in	Drapes/blinds	Exterior 50%
6		TIM	Double (Clear)	Yes	0.65	0.67	N	45.9 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
7	S	TIM	Double (Clear)	Yes	0.65	0.67	N	15.3 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%

INFILTRATION & VENTING

Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50	Forced Ventilation Supply	Forced Ventilation Exhaust	Run Time	Terrain/Wind Shielding
Proposed ACH	0.00036	1623	89.1	167.5	0.250	7.03	24	0	0	Suburban / Suburban

MASS

Mass Type	Area	Thickness	Furniture Fraction
No Added Mass	0 ft²	0 ft	0.3

COOLING SYSTEM

#	System Type	Efficiency	Capacity	Air Flow	SHR	WH Fans	Cross Vent
1	Central Unit	SEER: 13	36 kBtu/hr	1080 cfm	0.75		

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Building Input Summary Report

HOT WATER SYSTEM

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Electric	0.87	40 gal	60 gal	140 deg	None

HEATING SYSTEM

#	System Type	Efficiency	Capacity
1	Electric Strip Heat	COP: 1	36 kBtu/hr

SOLAR HOT WATER

Collector Type	Collector Tilt	Azimuth	Surface Area	Loss Coef.	Absorp. Prod.	Trans Corr.	Tank Volume	Tank U-Value	Tank Surf Area	Heat Exch Eff	PV Pumped	Pump Energy

DUCTS

#	Supply Location	Supply R-Value	Supply Area	Return Location	Return Area	Number	Leakage Type	Air Handler	CFM 25	Percent Leakage	QN	RLF
1	Attic	6	346.4 ft²	Crawlspace	86.6 ft²	1	Proposed Qn	Interior	183.92 cf	9.62 %	0.06	0.60

TEMPERATURES

Programable Thermostat: N Ceiling Fans: N

Cooling	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Heating	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Venting	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec

Thermostat Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Cooling (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Cooling (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78

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Building Input Summary Report

APPLIANCES & LIGHTING

Appliance Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Ceiling Fans (Summer)	AM	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.33	0.33	0.33	0.33	0.33
% Released: 100	PM	0.33	0.33	0.33	0.33	0.33	1	0.9	0.9	0.9	0.9	0.9	0.65
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Clothes Washer	AM	0.105	0.061	0.047	0.047	0.061	0.128	0.256	0.57	0.849	1	0.977	0.872
% Released: 60	PM	0.779	0.698	0.605	0.57	0.581	0.57	0.57	0.57	0.57	0.488	0.43	0.198
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dishwasher	AM	0.139	0.05	0.028	0.024	0.029	0.09	0.169	0.303	0.541	0.594	0.502	0.443
% Released: 60	PM	0.377	0.396	0.335	0.323	0.344	0.448	0.791	1	0.8	0.597	0.383	0.281
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dryer	AM	0.2	0.1	0.05	0.05	0.05	0.075	0.2	0.375	0.5	0.8	0.95	1
% Released: 10	PM	0.875	0.85	0.8	0.625	0.625	0.6	0.575	0.55	0.625	0.7	0.65	0.375
Annual Use: 891 kWh/Yr		Peak Value: 200 Watts											
Lighting	AM	0.16	0.15	0.16	0.18	0.23	0.45	0.4	0.26	0.19	0.16	0.12	0.11
% Released: 90	PM	0.16	0.17	0.25	0.27	0.34	0.55	0.55	0.88	1	0.86	0.51	0.28
Annual Use: 1841 kWh/Yr		Peak Value: 601 Watts											
Miscellaneous	AM	0.46	0.47	0.47	0.47	0.47	0.47	0.64	0.71	0.67	0.61	0.55	0.53
% Released: 90	PM	0.52	0.5	0.5	0.5	0.59	0.73	0.79	0.99	1	0.96	0.77	0.55
Annual Use: 2248 kWh/Yr		Peak Value: 412 Watts											
Pool Pump	AM	0	0	0	0	0	0	0	0	0	1	1	1
% Released: 0	PM	1	1	1	1	0	0	0	0	0	0	0	0
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Range	AM	0.057	0.057	0.057	0.057	0.057	0.114	0.171	0.286	0.343	0.343	0.343	0.4
% Released: 100	PM	0.457	0.343	0.286	0.4	0.571	1	0.657	0.429	0.286	0.229	0.171	0.114
Annual Use: 447 kWh/Yr		Peak Value: 165 Watts											
Refrigeration	AM	0.85	0.78	0.75	0.73	0.73	0.73	0.75	0.75	0.8	0.8	0.8	0.8
% Released: 100	PM	0.88	0.85	0.85	0.83	0.88	0.95	1	0.98	0.95	0.93	0.9	0.85
Annual Use: 775 kWh/Yr		Peak Value: 106 Watts											
Well Pump	AM	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.1	0.1
% Released: 0	PM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											

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Appendix 2 Southern Energy Standard Typical Input Summary

Annual Energy Summary

BAIHP / Southern Energy Home — Title: Southern Energy ES303 - std - typical User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/26/2007 14:06:16

Registration #:

STD construction

End-Use	Energy Consumption	Annual Cost
Cooling (33.2 kBtu/hr)	2998 kWh	$240
Cooling Fan	689 kWh	$55
Mechanical Vent Fan	0 kWh	$ 0
Total Cooling	**3687 kWh**	**$295**
Heating (29.1 kBtu/hr)	8916 kWh	$713
Heating Fan/Pump	409 kWh	$33
Mechanical Vent Fan	0 kWh	$ 0
Total Heating	**9325 kWh**	**$746**
Hot Water	4055 kWh	$324
Hot Water Pump	0 kWh	$0
Total Hot Water	**4055 kWh**	**$324**
Ceiling Fans	0 kWh	$0
Clothes Washer	0 kWh	$0
Dishwasher	0 kWh	$0
Dryer	891 kWh	$71
Lighting	1840 kWh	$147
Miscellaneous	2248 kWh	$180
Pool Pump	0 kWh	$0
Range	447 kWh	$36
Refrigerator	775 kWh	$62
Total (kWh)	23268 kWh	$1861
Total (Therms)	0 Therms	$0
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost	—	$1861

* Assumes net metering

Emissions (Calculated as Total - PV Produced)

SO2	80.26 Lbs.
NOX	64.94 Lbs.
CO2	13.8 Tons

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WORST CASE ROTATION - RATING BUILDING ENERGY SUMMARY

BAIHP / Southern Energy Homes — Title: Southern Energy ES303 - std - typical User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/26/2007 14:21:45

Registration #:

STD construction

	---- Cooling ----			---- Heating ----				HERS	
Rotation	Energy Use	Fan Energy	Cost	Energy Use	Fan/Pump	Cost	Total Energy	Index	e-Ratio
0	2769 kWh	626 kWh	$271	3571 kWh	166 kWh	$299	24.320 MBtu	114.03	
45	2934 kWh	672 kWh	$289	3677 kWh	173 kWh	$308	25.448 MBtu	117.36	
90	3024 kWh	694 kWh	$298	3534 kWh	168 kWh	$298	25.319 MBtu	117.25	
135	2931 kWh	670 kWh	$288	3491 kWh	164 kWh	$292	24.766 MBtu	115.61	
180	2784 kWh	634 kWh	$274	3493 kWh	164 kWh	$292	24.148 MBtu	113.66	
225	2977 kWh	682 kWh	$293	3592 kWh	169 kWh	$301	25.325 MBtu	117.14	
270	3033 kWh	698 kWh	$299	3522 kWh	168 kWh	$295	25.315 MBtu	117.27	
315	2920 kWh	668 kWh	$287	3539 kWh	168 kWh	$298	24.892 MBtu	115.90	

These results represent the most recent analysis when worst case was checked. For ratings where default appliance values were not used, the energy values will represent the building used for the HERS Score and not the entered building. Select Reports|Annual Simulation to view energy use from the current building.

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Building America
Site Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - std - typical — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Site
Total Space Heating:	7653	0	26.110	612	6677	0	22.784	534	12.7%
Heating:	7064	0	24.068	564	6366	0	21.717	509	
Heating Fan:	599	0	2.042	48	312	0	1.066	26	
Total Space Cooling:	5599	0	19.104	448	3944	0	13.457	316	29.6%
Cooling:	4771	0	16	382	3228	0	11	258	
Cooling Fan:	828	0	2.825	66	716	0	2.443	57	
Total Hot Water:	2902	0	9.903	232	2360	0	8.051	189	18.7%
Lighting Subtotal:	2094	0	7.145	148	2144	0	7.316	152	-2.4%
Wired Lighting:	1726	0	5.888	122	1776	0	6.057	126	-2.9%
Plug Lighting:	368	0	1.256	26	368	0	1.256	26	0.0%
Appliance Subtotal:	5461	0	18.633	436	5460	0	18.629	436	0.0%
Refrigerator:	669	0	2.283	54	669	0	2.283	54	0.0%
ClothesWasher:	105	0	0.358	8	105	0	0.358	8	0.0%
ClothesDryer:	835	0	2.849	67	835	0	2.849	67	0.0%
Dishwasher:	206	0	0.703	16	206	0	0.703	16	0.0%
Cooking:	605	0	2.064	48	604	0	2.061	48	0.2%
Other Appls:	3041	0	10.376	243	3041	0	10.376	243	0.0%
OAVentilation Fan:	187	0	0.636	15	187	0	0.636	15	0.0%
Total:	23895	0	81.530	1891	20772	0	70.874	1641	13.1%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**81.530**	**1891**	**20772**	**0**	**70.874**	**1641**	**13.1%**

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Building America
Source Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - std - typical — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Source
Total Space Heating:	7653	0	82.509	612	6677	0	71.996	534	12.7%
Heating:	7064	0	76.056	564	6366	0	68.627	509	
Heating Fan:	599	0	6.453	48	312	0	3.369	26	
Total Space Cooling:	5599	0	60.367	448	3944	0	42.524	316	29.6%
Cooling:	4771	0	51	382	3228	0	35	258	
Cooling Fan:	828	0	8.927	66	716	0	7.720	57	
Total Hot Water:	2902	0	31.293	232	2360	0	25.440	189	18.7%
Lighting Subtotal:	2094	0	22.577	148	2144	0	23.116	152	-2.4%
Wired Lighting:	1726	0	18.608	122	1776	0	19.142	126	-2.9%
Plug Lighting:	368	0	3.969	26	368	0	3.969	26	0.0%
Appliance Subtotal:	5461	0	58.879	436	5460	0	58.868	436	0.0%
Refrigerator:	669	0	7.213	54	669	0	7.213	54	0.0%
ClothesWasher:	105	0	1.132	8	105	0	1.132	8	0.0%
ClothesDryer:	835	0	9.003	67	835	0	9.003	67	0.0%
Dishwasher:	206	0	2.221	16	206	0	2.221	16	0.0%
Cooking:	605	0	6.523	48	604	0	6.512	48	0.2%
Other Appls:	3041	0	32.787	243	3041	0	32.787	243	0.0%
OAVentilation Fan:	187	0	2.011	15	187	0	2.011	15	0.0%
Total:	23895	0	257.634	1891	20772	0	223.962	1641	13.1%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**257.634**	**1891**	**20772**	**0**	**223.962**	**1641**	**13.1%**

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Appendix 3 Southern Energy Standard Typical Output Summaries

Building Input Summary Report

PROJECT

Title:	Southern Energy E6303 - std			Adress Type:	Street Address
Building Type:	User	New/Existing:	New (From Plans)	Lot #	
Owner:	BAIHP / Southern Energy Ho	Bedrooms:	3	SubDivision:	
# of Units:	1	Bathrooms:	2	PlatBook:	
Builder Name:		Conditioned Area:	1732	Street:	
Permit Office:		Total Stories:	1	County:	
Jurisdiction:		Worst Case:	Yes	City, State, Zip:	,
Family Type:	Single-family	Rotate Angle:	270		,
Comment:	STD construction				

CLIMATE

Design Location	Tmy Site	Design Temp 97.5 %	Design Temp 2.5 %	Int Design Temp Winter	Int Design Temp Summer	Heating Degree Days	Design Moisture	Daily Temp Range
LA, Baton Rouge	LA_BATONROUGE	29	93	70	75	1670	51	Medium

UTILITY RATES

Fuel	Unit	Utility Name	Monthly Fixed Cost	$/Unit
Electricity	kWh	Louisiana Average	0	0.08
Natural Gas	Therm	Louisiana Average	0	1.09
Fuel Oil	Gallon	Louisiana Default	0	1.1
Propane	Gallon	Louisiana Default	0	1.4

SURROUNDINGS

Ornt	Type	Shade Trees Height	Width	Distance	Exist	Adjacent Buildings Height	Width	Distance
N	None	ft	ft	ft		ft	ft	0 ft
NE	None	ft	ft	ft		ft	ft	0 ft
E	None	ft	ft	ft		ft	ft	0 ft
SE	None	ft	ft	ft		ft	ft	0 ft
S	None	ft	ft	ft		ft	ft	0 ft
SW	None	ft	ft	ft		ft	ft	0 ft
W	None	ft	ft	ft		ft	ft	0 ft
NW	None	ft	ft	ft		ft	ft	0 ft

FLOORS

#	Floor Type	Exposed Perimeter	Wall Ins. R-Value	Area	Floor Joist R-Value	Tile	Wood	Carpet
1	Crawlspace	177 ft	0	1732 ft²	11	0	0.25	0.75

ROOF

#	Roof Type	Materials	Attic Type	Attic Area	Roof Color	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1:n)	Pitch
1	Gable or shed	Composition shingles	Full attic	1732 ft²	Dark	0.96	N	0	300	14 deg

CEILING

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	19	1620 ft²	0.11	Wood
2	Under Attic	6	112 ft²	0.11	Wood

Building Input Summary Report

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	Width Ft	Width In	Height Ft	Height In	Area	Framing Fraction	Solar Absor.
1	N	Exterior	Frame - Wood	11	57.8	0	8	0	462.4 ft²	0.23	0.8
2	E	Exterior	Frame - Wood	11	15.1	0	9	0	135.9 ft²	0.23	0.8
3	W	Exterior	Frame - Wood	11	25.2	0	9	0	226.8 ft²	0.23	0.8
4	W	Exterior	Frame - Wood	11	4.8	0	8.4	0	40.32 ft²	0.23	0.8
5	S	Exterior	Frame - Wood	11	57.7	0	8	0	461.6 ft²	0.23	0.8
6	E	Exterior	Frame - Wood	11	9.8	0	8.75	0	85.75 ft²	0.23	0.8
7	E	Exterior	Frame - Wood	11	5.1	0	9.25	0	47.17 ft²	0.23	0.8

DOORS

#	Ornt	Door Type	Storms	U-Value	Width Ft	Width In	Height Ft	Height In	Area
1		Insulated	None	0.6	3	0	6.7	0	20.1 ft²
2		Insulated	None	0.6	3	0	6.7	0	20.1 ft²

WINDOWS

#	Ornt	Frame	Panes	NFRC	U-Factor	SHGC	Storm	Area	Overhang Depth	Overhang Separation	Interior Shade	Screening
1		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
2		TIM	Double (Clear)	Yes	0.65	0.67	N	12.5 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
3		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	1 ft 0 in	2 ft 0 in	None	Exterior 50%
4		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
5		TIM	Double (Clear)	Yes	0.65	0.67	N	11.25 ft²	0.75 ft 0 i	2.5 ft 0 in	Drapes/blinds	Exterior 50%
6		TIM	Double (Clear)	Yes	0.65	0.67	N	45.9 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
7	S	TIM	Double (Clear)	Yes	0.65	0.67	N	15.3 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%

INFILTRATION & VENTING

Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50	Forced Ventilation Supply	Forced Ventilation Exhaust	Run Time	Terrain/Wind Shielding
Proposed ACH	0.00036	1623	89.1	167.5	0.250	7.03	24	0	0	Suburban / Suburban

MASS

Mass Type	Area	Thickness	Furniture Fraction
No Added Mass	0 ft²	0 ft	0.3

COOLING SYSTEM

#	System Type	Efficiency	Capacity	Air Flow	SHR	WH Fans	Cross Vent
1	Central Unit	SEER: 13	36 kBtu/hr	1080 cfm	0.75		

Building Input Summary Report

HOT WATER SYSTEM

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Electric	0.87	40 gal	60 gal	140 deg	None

HEATING SYSTEM

#	System Type	Efficiency	Capacity
1	Electric Strip Heat	COP: 1	29.1 kBtu/hr

SOLAR HOT WATER

Collector Type	Collector Tilt	Azimuth	Surface Area	Loss Coef.	Absorp. Prod.	Trans Corr.	Tank Volume	Tank U-Value	Tank Surf Area	Heat Exch Eff	PV Pumped	Pump Energy

DUCTS

#	Supply Location	Supply R-Value	Supply Area	Return Location	Return Area	Number	Leakage Type	Air Handler	CFM 25	Percent Leakage	QN	RLF
1	Attic	6	346.4 ft²	Crawlspace	86.6 ft²	1	Proposed Qn	Interior	183.92 cf	10.43 %	0.06	0.60

TEMPERATURES

Programable Thermostat: N Ceiling Fans: N

Cooling	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Heating	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Venting	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec

Thermostat Schedule: HERS 2006 Reference

Schedule Type		Hours 1	2	3	4	5	6	7	8	9	10	11	12
Cooling (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Cooling (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78

Building Input Summary Report

APPLIANCES & LIGHTING

Appliance Schedule: HERS 2006 Reference

Schedule Type		Hours 1	2	3	4	5	6	7	8	9	10	11	12
Ceiling Fans (Summer)	AM	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.33	0.33	0.33	0.33	0.33
% Released: 100	PM	0.33	0.33	0.33	0.33	0.33	1	0.9	0.9	0.9	0.9	0.9	0.65
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Clothes Washer	AM	0.105	0.081	0.046	0.046	0.081	0.128	0.256	0.57	0.849	1	0.977	0.872
% Released: 60	PM	0.779	0.698	0.605	0.57	0.581	0.57	0.57	0.57	0.57	0.488	0.43	0.198
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dishwasher	AM	0.139	0.05	0.028	0.024	0.029	0.09	0.169	0.303	0.541	0.594	0.502	0.443
% Released: 60	PM	0.377	0.396	0.335	0.323	0.344	0.448	0.791	1	0.8	0.597	0.383	0.281
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dryer	AM	0.2	0.1	0.05	0.05	0.05	0.075	0.2	0.375	0.5	0.8	0.95	1
% Released: 10	PM	0.875	0.85	0.8	0.625	0.625	0.6	0.575	0.55	0.625	0.7	0.65	0.375
Annual Use: 891 kWh/Yr		Peak Value: 200 Watts											
Lighting	AM	0.16	0.15	0.16	0.18	0.23	0.45	0.4	0.26	0.19	0.16	0.12	0.11
% Released: 90	PM	0.16	0.17	0.25	0.27	0.34	0.55	0.55	0.88	1	0.86	0.51	0.28
Annual Use: 1841 kWh/Yr		Peak Value: 601 Watts											
Miscellaneous	AM	0.48	0.47	0.47	0.47	0.47	0.47	0.64	0.71	0.67	0.61	0.55	0.53
% Released: 90	PM	0.52	0.5	0.5	0.5	0.59	0.73	0.79	0.99	1	0.96	0.77	0.55
Annual Use: 2248 kWh/Yr		Peak Value: 412 Watts											
Pool Pump	AM	0	0	0	0	0	0	0	0	0	1	1	1
% Released: 0	PM	1	1	1	1	0	0	0	0	0	0	0	0
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Range	AM	0.057	0.057	0.057	0.057	0.057	0.114	0.171	0.286	0.343	0.343	0.343	0.4
% Released: 100	PM	0.457	0.343	0.286	0.4	0.571	1	0.857	0.429	0.286	0.229	0.171	0.114
Annual Use: 447 kWh/Yr		Peak Value: 165 Watts											
Refrigeration	AM	0.85	0.78	0.75	0.73	0.73	0.73	0.75	0.75	0.8	0.8	0.8	0.8
% Released: 100	PM	0.88	0.85	0.85	0.83	0.88	0.95	1	0.98	0.95	0.93	0.9	0.85
Annual Use: 775 kWh/Yr		Peak Value: 106 Watts											
Well Pump	AM	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.1	0.1
% Released: 0	PM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											

Appendix 4 Southern Energy Standard Perfect Input Summary

Annual Energy Summary

BAIHP / Southern Energy Home   Title: Southern Energy ES303 - std - perfect User   TMY City: LA_BATONROUGE
Elec Util: Louisiana Average
Gas Util: Louisiana Average
Registration #:   Run Date: 12/26/2007 11:39:40

STD construction

End-Use	Energy Consumption	Annual Cost
Cooling (36 kBtu/hr)	2906 kWh	$232
Cooling Fan	669 kWh	$54
Mechanical Vent Fan	0 kWh	$ 0
Total Cooling	**3575 kWh**	**$286**
Heating (36 kBtu/hr)	8403 kWh	$672
Heating Fan/Pump	396 kWh	$32
Mechanical Vent Fan	0 kWh	$ 0
Total Heating	**8799 kWh**	**$704**
Hot Water	4055 kWh	$324
Hot Water Pump	0 kWh	$0
Total Hot Water	**4055 kWh**	**$324**
Ceiling Fans	0 kWh	$0
Clothes Washer	0 kWh	$0
Dishwasher	0 kWh	$0
Dryer	891 kWh	$71
Lighting	1840 kWh	$147
Miscellaneous	2248 kWh	$180
Pool Pump	0 kWh	$0
Range	447 kWh	$36
Refrigerator	775 kWh	$62
Total (kWh)	22630 kWh	$1810
Total (Therms)	0 Therms	$0
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost	—	$1810

* Assumes net metering

Emissions (Calculated as Total - PV Produced)

SO2	78.06 Lbs.
NOX	63.15 Lbs.
CO2	13.42 Tons

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WORST CASE ROTATION - RATING BUILDING ENERGY SUMMARY

BAIHP / Southern Energy Homes   Title: Southern Energy ES303 - std - perfect User   TMY City: LA_BATONROUGE
Elec Util: Louisiana Average
Gas Util: Louisiana Average
Registration #:   Run Date: 12/26/2007 14:24:35

STD construction

	Cooling			Heating				HERS	
Rotation	Energy Use	Fan Energy	Cost	Energy Use	Fan/Pump	Cost	Total Energy	Index	e-Ratio
0	2680 kWh	602 kWh	$261	3320 kWh	162 kWh	$279	23.018 MBtu	110.48	
45	2834 kWh	644 kWh	$279	3419 kWh	167 kWh	$287	24.109 MBtu	113.89	
90	2928 kWh	668 kWh	$287	3286 kWh	160 kWh	$276	24.031 MBtu	113.74	
135	2832 kWh	643 kWh	$278	3244 kWh	156 kWh	$273	23.472 MBtu	112.07	
180	2688 kWh	606 kWh	$264	3246 kWh	159 kWh	$273	22.871 MBtu	110.18	
225	2877 kWh	656 kWh	$282	3340 kWh	163 kWh	$280	24.010 MBtu	113.56	
270	2937 kWh	670 kWh	$289	3274 kWh	160 kWh	$275	24.031 MBtu	113.78	
315	2820 kWh	641 kWh	$277	3290 kWh	161 kWh	$276	23.591 MBtu	112.35	

These results represent the most recent analysis when worst case was checked. For ratings where default appliance values were not used, the energy values will represent the building used for the HERS Score and not the entered building. Select Reports|Annual Simulation to view energy use from the current building.

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Building America

Site Energy Summary 2007

BAIHP / Southern Energy Homes   Project Title: Southern Energy ES303 - std - perfect   Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark				Prototype				Savings
	kWh	Therms	MBTU	Cost	kWh	Therms	MBTU	Cost	Site
Total Space Heating:	7653	0	26.110	612	6377	0	21.757	510	16.7%
Heating:	7054	0	24.068	564	6073	0	20.721	486	
Heating Fan:	599	0	2.042	48	304	0	1.036	24	
Total Space Cooling:	5599	0	19.104	448	3834	0	13.081	307	31.5%
Cooling:	4771	0	16	382	3138	0	11	251	
Cooling Fan:	828	0	2.825	66	696	0	2.376	56	
Total Hot Water:	2902	0	9.903	232	2360	0	8.051	189	18.7%
Lighting Subtotal:	2094	0	7.145	148	2144	0	7.316	152	-2.4%
Wired Lighting:	1726	0	5.888	122	1775	0	6.057	126	-2.9%
Plug Lighting:	368	0	1.256	26	368	0	1.256	26	0.0%
Appliance Subtotal:	5461	0	18.633	436	5460	0	18.629	436	0.0%
Refrigerator:	669	0	2.283	54	669	0	2.283	54	0.0%
ClothesWasher:	105	0	0.358	8	105	0	0.358	8	0.0%
ClothesDryer:	835	0	2.849	67	835	0	2.849	67	0.0%
Dishwasher:	206	0	0.703	16	206	0	0.703	16	0.0%
Cooking:	605	0	2.064	48	604	0	2.061	48	0.2%
Other Appls:	3041	0	10.376	243	3041	0	10.376	243	0.0%
OAVentilation Fan:	187	0	0.636	15	187	0	0.636	15	0.0%
Total:	23895	0	81.530	1891	20360	0	69.468	1609	14.8%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**81.530**	**1891**	**20360**	**0**	**69.468**	**1609**	**14.8%**

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Building America

Source Energy Summary 2007

BAIHP / Southern Energy Homes   Project Title: Southern Energy ES303 - std - perfect   Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark				Prototype				Savings
	kWh	Therms	MBTU	Cost	kWh	Therms	MBTU	Cost	Source
Total Space Heating:	7653	0	82.509	612	6377	0	68.751	510	16.7%
Heating:	7054	0	76.056	564	6073	0	65.479	486	
Heating Fan:	599	0	6.453	48	304	0	3.272	24	
Total Space Cooling:	5599	0	60.367	448	3834	0	41.337	307	31.5%
Cooling:	4771	0	51	382	3138	0	34	251	
Cooling Fan:	828	0	8.927	66	696	0	7.504	56	
Total Hot Water:	2902	0	31.293	232	2360	0	25.440	189	18.7%
Lighting Subtotal:	2094	0	22.577	148	2144	0	23.116	152	-2.4%
Wired Lighting:	1726	0	18.608	122	1775	0	19.142	126	-2.9%
Plug Lighting:	368	0	3.969	26	368	0	3.969	26	0.0%
Appliance Subtotal:	5461	0	58.879	436	5460	0	58.868	436	0.0%
Refrigerator:	669	0	7.213	54	669	0	7.213	54	0.0%
ClothesWasher:	105	0	1.132	8	105	0	1.132	8	0.0%
ClothesDryer:	835	0	9.003	67	835	0	9.003	67	0.0%
Dishwasher:	206	0	2.221	16	206	0	2.221	16	0.0%
Cooking:	605	0	6.523	48	604	0	6.512	48	0.2%
Other Appls:	3041	0	32.787	243	3041	0	32.787	243	0.0%
OAVentilation Fan:	187	0	2.011	15	187	0	2.011	15	0.0%
Total:	23895	0	257.634	1891	20360	0	219.520	1609	14.8%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**257.634**	**1891**	**20360**	**0**	**219.520**	**1609**	**14.8%**

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Appendix 5 Southern Energy Standard Perfect Output Summaries

Building Input Summary Report

PROJECT

Title:	Southern Energy E6303 - soff			Adress Type:	Street Address
Building Type:	User	New/Existing:	New (From Plans)	Lot #	
Owner:	BAIHP / Southern Energy Ho	Bedrooms:	3	SubDivision:	
# of Units:	1	Bathrooms:	2	PlatBook:	
Builder Name:		Conditioned Area:	1732	Street:	
Permit Office:		Total Stories:	1	County:	
Jurisdiction:		Worst Case:	Yes	City, State, Zip:	,
Family Type:	Single-family	Rotate Angle:	45		,
Comment:	soffit construction				

CLIMATE

Design Location	Tmy Site	Design Temp 97.5 %	Design Temp 2.5 %	Int Design Temp Winter	Int Design Temp Summer	Heating Degree Days	Design Moisture	Daily Temp Range
LA, Baton Rouge	LA_BATONROUGE	29	93	70	75	1670	51	Medium

UTILITY RATES

Fuel	Unit	Utility Name	Monthly Fixed Cost	$/Unit
Electricity	kWh	Louisiana Average	0	0.08
Natural Gas	Therm	Louisiana Average	0	1.09
Fuel Oil	Gallon	Louisiana Default	0	1.1
Propane	Gallon	Louisiana Default	0	1.4

SURROUNDINGS

Ornt	Type	Shade Trees Height	Width	Distance	Exist	Adjacent Buildings Height	Width	Distance
N	None	ft	ft	ft		ft	ft	0 ft
NE	None	ft	ft	ft		ft	ft	0 ft
E	None	ft	ft	ft		ft	ft	0 ft
SE	None	ft	ft	ft		ft	ft	0 ft
S	None	ft	ft	ft		ft	ft	0 ft
SW	None	ft	ft	ft		ft	ft	0 ft
W	None	ft	ft	ft		ft	ft	0 ft
NW	None	ft	ft	ft		ft	ft	0 ft

FLOORS

#	Floor Type	Exposed Perimeter	Wall Ins. R-Value	Area	Floor Joist R-Value	Tile	Wood	Carpet
1	Crawlspace	177 ft	0	1732 ft²	11	0	0.25	0.75

ROOF

#	Roof Type	Materials	Attic Type	Attic Area	Roof Color	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1in)	Pitch
1	Gable or shed	Composition shingles	Full attic	1732 ft²	Dark	0.96	N	0	300	14 deg

CEILING

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	19	1732 ft²	0.11	Wood

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Building Input Summary Report

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	Width Ft	Width In	Height Ft	Height In	Area	Framing Fraction	Solar Absor.
1	N	Exterior	Frame - Wood	11	57.8	0	8	0	462.4 ft²	0.23	0.8
2	E	Exterior	Frame - Wood	11	15.1	0	9	0	135.9 ft²	0.23	0.8
3	W	Exterior	Frame - Wood	11	25.2	0	9	0	226.8 ft²	0.23	0.8
4	W	Exterior	Frame - Wood	11	4.8	0	8.4	0	40.32 ft²	0.23	0.8
5	S	Exterior	Frame - Wood	11	57.7	0	8	0	461.6 ft²	0.23	0.8
6	E	Exterior	Frame - Wood	11	9.8	0	8.75	0	85.75 ft²	0.23	0.8
7	E	Exterior	Frame - Wood	11	5.1	0	9.25	0	47.17 ft²	0.23	0.8

DOORS

#	Ornt	Door Type	Storms	U-Value	Width Ft	Width In	Height Ft	Height In	Area
1		Insulated	None	0.6	3	0	6.7	0	20.1 ft²
2		Insulated	None	0.6	3	0	6.7	0	20.1 ft²

WINDOWS

#	Ornt	Frame	Panes	NFRC	U-Factor	SHGC	Storm	Area	Overhang Depth / Separation	Interior Shade	Screening
1		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i 1 ft 0 in	Drapes/blinds	Exterior 50%
2		TIM	Double (Clear)	Yes	0.65	0.67	N	12.5 ft²	0.75 ft 0 i 1 ft 0 in	None	Exterior 50%
3		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	1 ft 0 in 2 ft 0 in	None	Exterior 50%
4		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i 1 ft 0 in	Drapes/blinds	Exterior 50%
5		TIM	Double (Clear)	Yes	0.65	0.67	N	11.25 ft²	0.75 ft 0 i 2.5 ft 0 in	Drapes/blinds	Exterior 50%
6		TIM	Double (Clear)	Yes	0.65	0.67	N	45.9 ft²	0.75 ft 0 i 1 ft 0 in	None	Exterior 50%
7	S	TIM	Double (Clear)	Yes	0.65	0.67	N	15.3 ft²	0.75 ft 0 i 1 ft 0 in	Drapes/blinds	Exterior 50%

INFILTRATION & VENTING

Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50	Forced Ventilation Supply	Forced Ventilation Exhaust	Run Time	Terrain/Wind Shielding
Proposed ACH	0.00036	1623	89.1	167.5	0.250	7.03	24	0	0	Suburban / Suburban

MASS

Mass Type	Area	Thickness	Furniture Fraction
No Added Mass	0 ft²	0 ft	0.3

COOLING SYSTEM

#	System Type	Efficiency	Capacity	Air Flow	SHR	WH Fans	Cross Vent
1	Central Unit	SEER: 13	36 kBtu/hr	1080 cfm	0.75		

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Building Input Summary Report

HOT WATER SYSTEM

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Electric	0.87	40 gal	60 gal	140 deg	None

HEATING SYSTEM

#	System Type	Efficiency	Capacity
1	Electric Strip Heat	COP: 1	36 kBtu/hr

SOLAR HOT WATER

Collector Type	Collector Tilt	Azimuth	Surface Area	Loss Coef.	Absorp. Prod.	Trans Corr.	Tank Volume	Tank U-Value	Tank Surf Area	Heat Exch Eff	PV Pumped	Pump Energy

DUCTS

#	Supply Location	Supply R-Value	Supply Area	Return Location	Return Area	Number	Leakage Type	Air Handler	CFM 25	Percent Leakage	QN	RLF
1	Interior	6	346.4 ft²	Interior	86.6 ft²	1	Proposed Qn	Interior	17.32 cfm	1.60 %	0.01	0.60

TEMPERATURES

Programable Thermostat: N Ceiling Fans: N

Cooling / Heating / Venting: [X] Jan [X] Feb [X] Mar [X] Apr [X] May [X] Jun [X] Jul [X] Aug [X] Sep [X] Oct [X] Nov [X] Dec

Thermostat Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Cooling (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Cooling (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WD)	AM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	PM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Heating (WEH)	AM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	PM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Building Input Summary Report

APPLIANCES & LIGHTING

Appliance Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Ceiling Fans (Summer)	AM	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.33	0.33	0.33	0.33	0.33
% Released: 100	PM	0.33	0.33	0.33	0.33	0.33	1	0.9	0.9	0.9	0.9	0.9	0.65
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Clothes Washer	AM	0.105	0.061	0.046	0.046	0.061	0.128	0.256	0.57	0.849	1	0.977	0.872
% Released: 60	PM	0.779	0.698	0.605	0.57	0.581	0.57	0.57	0.57	0.57	0.488	0.43	0.198
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dishwasher	AM	0.139	0.05	0.028	0.024	0.029	0.09	0.169	0.303	0.541	0.594	0.502	0.443
% Released: 60	PM	0.377	0.396	0.335	0.323	0.344	0.448	0.791	1	0.8	0.597	0.383	0.281
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dryer	AM	0.2	0.1	0.05	0.05	0.05	0.075	0.2	0.375	0.5	0.8	0.95	1
% Released: 10	PM	0.875	0.85	0.8	0.625	0.625	0.6	0.575	0.55	0.625	0.7	0.65	0.375
Annual Use: 891 kWh/Yr		Peak Value: 200 Watts											
Lighting	AM	0.16	0.15	0.16	0.18	0.23	0.45	0.4	0.26	0.19	0.16	0.12	0.11
% Released: 90	PM	0.16	0.17	0.25	0.27	0.34	0.55	0.55	0.88	1	0.86	0.51	0.28
Annual Use: 1841 kWh/Yr		Peak Value: 601 Watts											
Miscellaneous	AM	0.46	0.47	0.47	0.47	0.47	0.47	0.64	0.71	0.67	0.61	0.55	0.53
% Released: 90	PM	0.52	0.5	0.5	0.5	0.59	0.73	0.79	0.99	1	0.96	0.77	0.55
Annual Use: 2248 kWh/Yr		Peak Value: 412 Watts											
Pool Pump	AM	0	0	0	0	0	0	0	0	0	1	1	1
% Released: 0	PM	1	1	1	1	0	0	0	0	0	0	0	0
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Range	AM	0.057	0.057	0.057	0.057	0.057	0.114	0.171	0.286	0.343	0.343	0.343	0.4
% Released: 100	PM	0.457	0.343	0.286	0.4	0.571	1	0.657	0.429	0.286	0.229	0.171	0.114
Annual Use: 447 kWh/Yr		Peak Value: 165 Watts											
Refrigeration	AM	0.85	0.78	0.75	0.73	0.73	0.73	0.75	0.75	0.8	0.8	0.8	0.8
% Released: 100	PM	0.88	0.85	0.85	0.83	0.88	0.95	1	0.98	0.95	0.93	0.9	0.85
Annual Use: 775 kWh/Yr		Peak Value: 106 Watts											
Well Pump	AM	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.1	0.1
% Released: 0	PM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											

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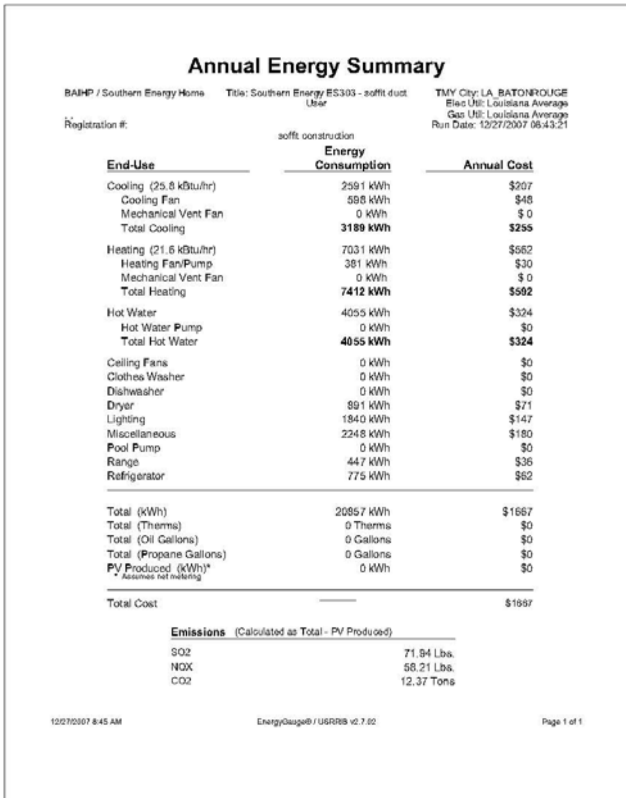
Appendix 6 Southern Energy Soffit Input Summary



Annual Energy Summary

BAIHP / Southern Energy Home — Title: Southern Energy ES303 - soffit duct User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/27/2007 08:43:21

Registration #:

soffit construction

End-Use	Energy Consumption	Annual Cost
Cooling (25.8 kBtu/hr)	2591 kWh	$207
Cooling Fan	598 kWh	$48
Mechanical Vent Fan	0 kWh	$ 0
Total Cooling	**3189 kWh**	**$255**
Heating (21.6 kBtu/hr)	7031 kWh	$562
Heating Fan/Pump	381 kWh	$30
Mechanical Vent Fan	0 kWh	$ 0
Total Heating	**7412 kWh**	**$592**
Hot Water	4055 kWh	$324
Hot Water Pump	0 kWh	$0
Total Hot Water	**4055 kWh**	**$324**
Ceiling Fans	0 kWh	$0
Clothes Washer	0 kWh	$0
Dishwasher	0 kWh	$0
Dryer	891 kWh	$71
Lighting	1840 kWh	$147
Miscellaneous	2248 kWh	$180
Pool Pump	0 kWh	$0
Range	447 kWh	$36
Refrigerator	775 kWh	$62
Total (kWh)	20857 kWh	$1667
Total (Therms)	0 Therms	$0
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost	——	$1667

* Assumes net metering

Emissions (Calculated as Total - PV Produced)	
SO2	71.94 Lbs.
NOX	58.21 Lbs.
CO2	12.37 Tons

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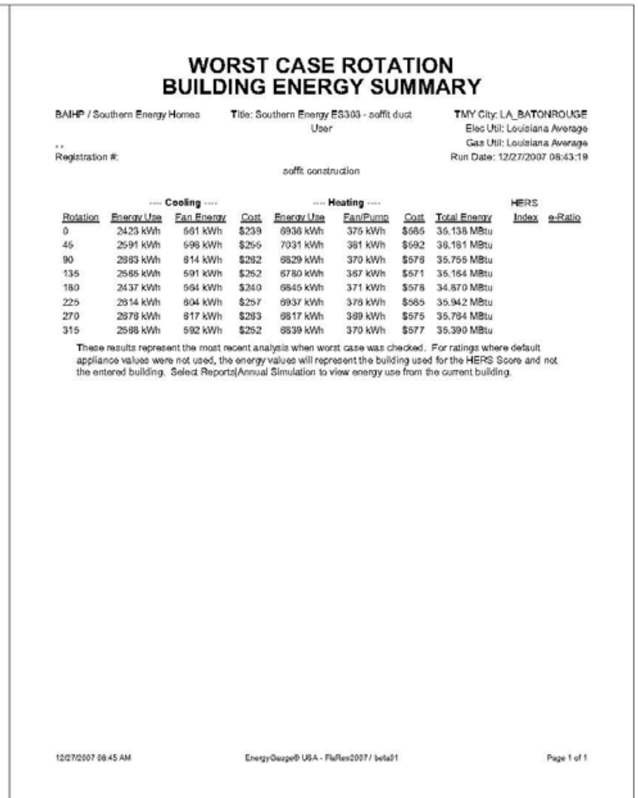

WORST CASE ROTATION BUILDING ENERGY SUMMARY

BAIHP / Southern Energy Homes — Title: Southern Energy ES303 - soffit duct User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/27/2007 08:43:19

Registration #:

soffit construction

	---- Cooling ----			---- Heating ----				HERS	
Rotation	Energy Use	Fan Energy	Cost	Energy Use	Fan/Pump	Cost	Total Energy	Index	e-Ratio
0	2423 kWh	561 kWh	$239	6936 kWh	375 kWh	$585	35.138 MBtu		
45	2591 kWh	598 kWh	$255	7031 kWh	381 kWh	$592	36.161 MBtu		
90	2883 kWh	614 kWh	$282	6829 kWh	370 kWh	$576	35.755 MBtu		
135	2565 kWh	591 kWh	$252	6780 kWh	367 kWh	$571	35.164 MBtu		
180	2437 kWh	564 kWh	$240	6845 kWh	371 kWh	$576	34.870 MBtu		
225	2614 kWh	604 kWh	$257	6937 kWh	376 kWh	$585	35.942 MBtu		
270	2878 kWh	617 kWh	$283	6817 kWh	369 kWh	$575	35.764 MBtu		
315	2568 kWh	592 kWh	$252	6839 kWh	370 kWh	$577	35.390 MBtu		

These results represent the most recent analysis when worst case was checked. For ratings where default appliance values were not used, the energy values will represent the building used for the HERS Score and not the entered building. Select Reports|Annual Simulation to view energy use from the current building.

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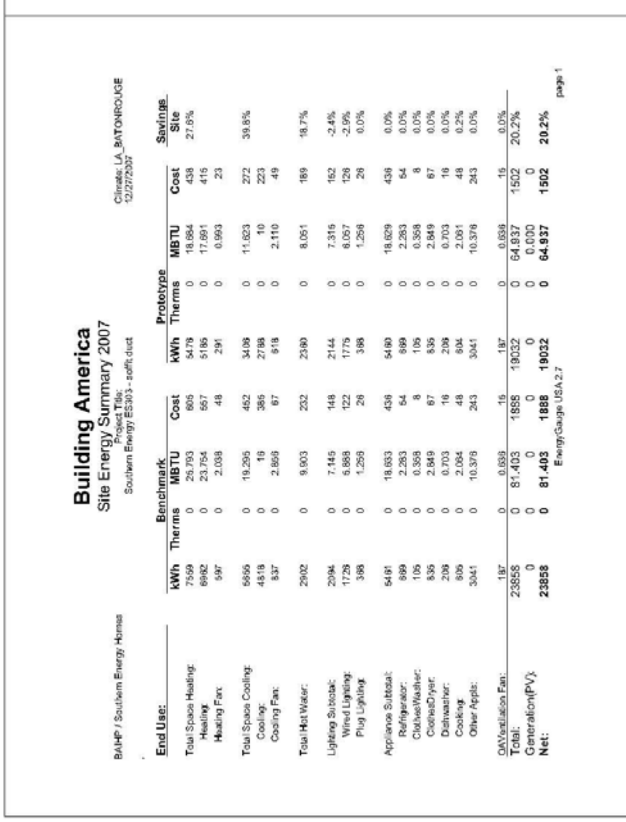

Building America
Site Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - soffit duct — Climate: LA_BATONROUGE 12/27/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Site
Total Space Heating:	7559	0	26.793	605	5476	0	18.684	438	27.6%
Heating:	6962	0	23.754	557	5185	0	17.691	415	
Heating Fan:	597	0	2.038	48	291	0	0.993	23	
Total Space Cooling:	5655	0	19.295	452	3406	0	11.623	272	39.8%
Cooling:	4818	0	16	385	2788	0	10	223	
Cooling Fan:	837	0	2.856	67	618	0	2.110	49	
Total Hot Water:	2902	0	9.903	232	2360	0	8.051	189	18.7%
Lighting Subtotal:	2094	0	7.145	148	2144	0	7.316	152	-2.4%
Wired Lighting:	1726	0	5.888	122	1775	0	6.057	126	-2.9%
Plug Lighting:	368	0	1.256	26	368	0	1.256	26	0.0%
Appliance Subtotal:	5461	0	18.633	436	5460	0	18.629	436	0.0%
Refrigerator:	669	0	2.283	54	669	0	2.283	54	0.0%
ClothesWasher:	105	0	0.358	8	105	0	0.358	8	0.0%
ClothesDryer:	835	0	2.849	67	835	0	2.849	67	0.0%
Dishwasher:	206	0	0.703	16	206	0	0.703	16	0.0%
Cooking:	605	0	2.064	48	604	0	2.061	48	0.2%
Other Appls:	3041	0	10.376	243	3041	0	10.376	243	0.0%
OAVentilation Fan:	187	0	0.638	15	187	0	0.638	15	0.0%
Total:	23858	0	81.403	1888	19032	0	64.937	1502	20.2%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23858**	**0**	**81.403**	**1888**	**19032**	**0**	**64.937**	**1502**	**20.2%**

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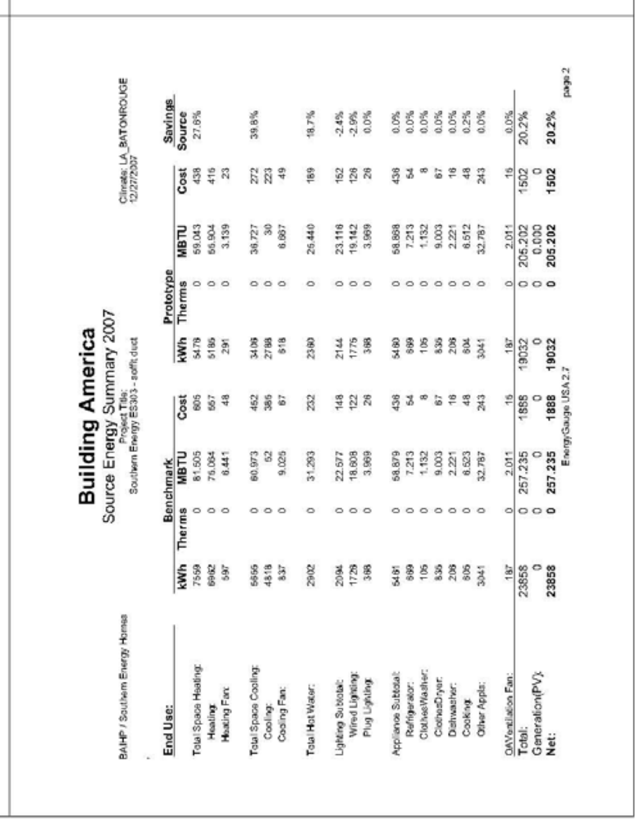

Building America
Source Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - soffit duct — Climate: LA_BATONROUGE 12/27/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Source
Total Space Heating:	7559	0	81.505	605	5476	0	59.043	438	27.6%
Heating:	6962	0	75.064	557	5185	0	55.904	415	
Heating Fan:	597	0	6.441	48	291	0	3.139	23	
Total Space Cooling:	5655	0	60.973	452	3406	0	36.727	272	39.8%
Cooling:	4818	0	52	385	2788	0	30	223	
Cooling Fan:	837	0	9.025	67	618	0	6.667	49	
Total Hot Water:	2902	0	31.293	232	2360	0	25.440	189	18.7%
Lighting Subtotal:	2094	0	22.577	148	2144	0	23.116	152	-2.4%
Wired Lighting:	1726	0	18.608	122	1775	0	19.142	126	-2.9%
Plug Lighting:	368	0	3.969	26	368	0	3.969	26	0.0%
Appliance Subtotal:	5461	0	58.879	436	5460	0	58.868	436	0.0%
Refrigerator:	669	0	7.213	54	669	0	7.213	54	0.0%
ClothesWasher:	105	0	1.132	8	105	0	1.132	8	0.0%
ClothesDryer:	835	0	9.003	67	835	0	9.003	67	0.0%
Dishwasher:	206	0	2.221	16	206	0	2.221	16	0.0%
Cooking:	605	0	6.523	48	604	0	6.512	48	0.2%
Other Appls:	3041	0	32.787	243	3041	0	32.787	243	0.0%
OAVentilation Fan:	187	0	2.011	15	187	0	2.011	15	0.0%
Total:	23858	0	257.235	1888	19032	0	205.202	1502	20.2%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23858**	**0**	**257.235**	**1888**	**19032**	**0**	**205.202**	**1502**	**20.2%**

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Appendix 7 Southern Energy Soffit Output Summaries

Building Input Summary Report

PROJECT

Title:	Southern Energy E6303 - std			Adress Type:	Street Address
Building Type:	User	New/Existing:	New (From Plans)	Lot #	
Owner:	BAIHP / Southern Energy Ho	Bedrooms:	3	SubDivision:	
# of Units:	1	Bathrooms:	2	PlatBook:	
Builder Name:		Conditioned Area:	1732	Street:	
Permit Office:		Total Stories:	1	County:	
Jurisdiction:		Worst Case:	No	City, State, Zip:	,
Family Type:	Single-family	Rotate Angle:	45		,
Comment:	STD construction				

CLIMATE

Design Location	Tmy Site	Design Temp 97.5 %	Design Temp 2.5 %	Int Design Temp Winter	Int Design Temp Summer	Heating Degree Days	Design Moisture	Daily Temp Range
LA, Baton Rouge	LA_BATONROUGE	29	93	70	75	1670	51	Medium

UTILITY RATES

Fuel	Unit	Utility Name	Monthly Fixed Cost	$/Unit
Electricity	kWh	Louisiana Average	0	0.08
Natural Gas	Therm	Louisiana Average	0	1.09
Fuel Oil	Gallon	Louisiana Default	0	1.1
Propane	Gallon	Louisiana Default	0	1.4

SURROUNDINGS

Ornt	Type	Shade Trees Height	Width	Distance	Exist	Adjacent Buildings Height	Width	Distance
N	None	ft	ft	ft		ft	ft	0 ft
NE	None	ft	ft	ft		ft	ft	0 ft
E	None	ft	ft	ft		ft	ft	0 ft
SE	None	ft	ft	ft		ft	ft	0 ft
S	None	ft	ft	ft		ft	ft	0 ft
SW	None	ft	ft	ft		ft	ft	0 ft
W	None	ft	ft	ft		ft	ft	0 ft
NW	None	ft	ft	ft		ft	ft	0 ft

FLOORS

#	Floor Type	Exposed Perimeter	Wall Ins. R-Value	Area	Floor Joist R-Value	Tile	Wood	Carpet
1	Crawlspace	177 ft	0	1732 ft²	11	0	0.25	0.75

ROOF

#	Roof Type	Materials	Attic Type	Attic Area	Roof Color	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1 in)	Pitch
1	Gable or shed	Composition shingles	Full attic	1732 ft²	Dark	0.96	N	0	300	14 deg

CEILING

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	19	1620 ft²	0.11	Wood
2	Under Attic	6	112 ft²	0.11	Wood

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Building Input Summary Report

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	Width Ft	Width In	Height Ft	Height In	Area	Framing Fraction	Solar Absor.
1	N	Exterior	Frame - Wood	11	57.8	0	8	0	462.4 ft²	0.23	0.8
2	E	Exterior	Frame - Wood	11	15.1	0	9	0	135.9 ft²	0.23	0.8
3	W	Exterior	Frame - Wood	11	25.2	0	9	0	226.8 ft²	0.23	0.8
4	W	Exterior	Frame - Wood	11	4.8	0	8.4	0	40.32 ft²	0.23	0.8
5	S	Exterior	Frame - Wood	11	57.7	0	8	0	461.6 ft²	0.23	0.8
6	E	Exterior	Frame - Wood	11	9.8	0	8.75	0	85.75 ft²	0.23	0.8
7	E	Exterior	Frame - Wood	11	5.1	0	9.25	0	47.17 ft²	0.23	0.8

DOORS

#	Ornt	Door Type	Storms	U-Value	Width Ft	Width In	Height Ft	Height In	Area
1		Insulated	None	0.6	3	0	6.7	0	20.1 ft²
2		Insulated	None	0.6	3	0	6.7	0	20.1 ft²

WINDOWS

#	Ornt	Frame	Panes	NFRC	U-Factor	SHGC	Storm	Area	Overhang Depth	Overhang Separation	Interior Shade	Screening
1		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
2		TIM	Double (Clear)	Yes	0.65	0.67	N	12.5 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
3		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	1 ft 0 in	2 ft 0 in	None	Exterior 50%
4		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
5		TIM	Double (Clear)	Yes	0.65	0.67	N	11.25 ft²	0.75 ft 0 i	2.5 ft 0 in	Drapes/blinds	Exterior 50%
6		TIM	Double (Clear)	Yes	0.65	0.67	N	45.9 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
7	S	TIM	Double (Clear)	Yes	0.65	0.67	N	15.3 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%

INFILTRATION & VENTING

Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50	Forced Ventilation Supply	Forced Ventilation Exhaust	Run Time	Terrain/Wind Shielding
Proposed ACH	0.00036	1623	89.1	167.5	0.250	7.03	24	0	0	Suburban / Suburban

MASS

Mass Type	Area	Thickness	Furniture Fraction
No Added Mass	0 ft²	0 ft	0.3

COOLING SYSTEM

#	System Type	Efficiency	Capacity	Air Flow	SHR	WH Fans	Cross Vent
1	Central Unit	SEER: 13	36 kBtu/hr	1080 cfm	0.75		

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Building Input Summary Report

HOT WATER SYSTEM

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Electric	0.87	40 gal	60 gal	140 deg	None

HEATING SYSTEM

#	System Type	Efficiency	Capacity
1	Electric Strip Heat	COP: 1	36 kBtu/hr

SOLAR HOT WATER

Collector Type	Collector Tilt	Azimuth	Surface Area	Loss Coef.	Absorp. Prod.	Trans Corr.	Tank Volume	Tank U-Value	Tank Surf Area	Heat Exch Eff	PV Pumped	Pump Energy

DUCTS

#	Supply Location	Supply R-Value	Supply Area	Return Location	Return Area	Number	Leakage Type	Air Handler	CFM 25	Percent Leakage	QN	RLF
1	Attic	6	346.4 ft²	Crawlspace	86.6 ft²	1	Proposed Qn	Interior	163.92 cf	9.62 %	0.06	0.60

TEMPERATURES

Programable Thermostat: N   Ceiling Fans: N

Cooling	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Heating	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Venting	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec

Thermostat Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Cooling (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Cooling (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78

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Building Input Summary Report

APPLIANCES & LIGHTING

Appliance Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Ceiling Fans (Summer)	AM	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.33	0.33	0.33	0.33	0.33
% Released: 100	PM	0.33	0.33	0.33	0.33	0.33	1	0.9	0.9	0.9	0.9	0.9	0.65
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Clothes Washer	AM	0.105	0.061	0.047	0.047	0.061	0.128	0.256	0.57	0.849	1	0.977	0.872
% Released: 60	PM	0.779	0.698	0.605	0.57	0.581	0.57	0.57	0.57	0.57	0.488	0.43	0.198
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dishwasher	AM	0.139	0.05	0.028	0.024	0.029	0.09	0.169	0.303	0.541	0.594	0.502	0.443
% Released: 60	PM	0.377	0.396	0.335	0.323	0.344	0.448	0.791	1	0.8	0.597	0.383	0.281
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dryer	AM	0.2	0.1	0.05	0.05	0.05	0.075	0.2	0.375	0.5	0.8	0.95	1
% Released: 10	PM	0.875	0.65	0.6	0.625	0.625	0.6	0.575	0.55	0.625	0.7	0.65	0.375
Annual Use: 891 kWh/Yr		Peak Value: 200 Watts											
Lighting	AM	0.16	0.15	0.16	0.18	0.23	0.45	0.4	0.26	0.19	0.16	0.12	0.11
% Released: 90	PM	0.16	0.17	0.25	0.27	0.34	0.55	0.55	0.88	1	0.86	0.51	0.28
Annual Use: 1841 kWh/Yr		Peak Value: 601 Watts											
Miscellaneous	AM	0.46	0.47	0.47	0.47	0.47	0.47	0.64	0.71	0.67	0.61	0.55	0.53
% Released: 90	PM	0.52	0.5	0.5	0.5	0.59	0.73	0.79	0.99	1	0.96	0.77	0.55
Annual Use: 2248 kWh/Yr		Peak Value: 412 Watts											
Pool Pump	AM	0	0	0	0	0	0	0	0	0	1	1	1
% Released: 0	PM	1	1	1	1	0	0	0	0	0	0	0	0
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Range	AM	0.057	0.057	0.057	0.057	0.057	0.114	0.171	0.286	0.343	0.343	0.343	0.4
% Released: 100	PM	0.457	0.343	0.286	0.4	0.571	1	0.857	0.429	0.286	0.229	0.171	0.114
Annual Use: 447 kWh/Yr		Peak Value: 165 Watts											
Refrigeration	AM	0.85	0.78	0.75	0.73	0.73	0.73	0.75	0.75	0.8	0.8	0.8	0.8
% Released: 100	PM	0.88	0.85	0.85	0.83	0.88	0.95	1	0.98	0.95	0.93	0.9	0.85
Annual Use: 775 kWh/Yr		Peak Value: 106 Watts											
Well Pump	AM	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.1	0.1
% Released: 0	PM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											

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Appendix 8 Cavalier Standard Typical Input Summary

Annual Energy Summary

BAIHP / Southern Energy Home — Title: Southern Energy ES303 - std - typical User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/26/2007 14:06:16

Registration #:

STD construction

End-Use	Energy Consumption	Annual Cost
Cooling (33.2 kBtu/hr)	2998 kWh	$240
Cooling Fan	689 kWh	$55
Mechanical Vent Fan	0 kWh	$ 0
Total Cooling	**3687 kWh**	**$295**
Heating (29.1 kBtu/hr)	8916 kWh	$713
Heating Fan/Pump	409 kWh	$33
Mechanical Vent Fan	0 kWh	$ 0
Total Heating	**9325 kWh**	**$746**
Hot Water	4055 kWh	$324
Hot Water Pump	0 kWh	$0
Total Hot Water	**4055 kWh**	**$324**
Ceiling Fans	0 kWh	$0
Clothes Washer	0 kWh	$0
Dishwasher	0 kWh	$0
Dryer	891 kWh	$71
Lighting	1840 kWh	$147
Miscellaneous	2248 kWh	$180
Pool Pump	0 kWh	$0
Range	447 kWh	$36
Refrigerator	775 kWh	$62
Total (kWh)	23268 kWh	$1861
Total (Therms)	0 Therms	$0
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost	—	$1861

* Assumes net metering

Emissions (Calculated as Total - PV Produced)

SO2	80.26 Lbs.
NOX	64.94 Lbs.
CO2	13.8 Tons

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WORST CASE ROTATION - RATING BUILDING ENERGY SUMMARY

BAIHP / Southern Energy Homes — Title: Southern Energy ES303 - std - typical User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/26/2007 14:21:45

Registration #:

STD construction

	Cooling			Heating				HERS	
Rotation	Energy Use	Fan Energy	Cost	Energy Use	Fan/Pump	Cost	Total Energy	Index	e-Ratio
0	2769 kWh	626 kWh	$271	3571 kWh	166 kWh	$299	24.320 MBtu	114.03	
45	2934 kWh	672 kWh	$289	3677 kWh	173 kWh	$308	25.448 MBtu	117.36	
90	3024 kWh	694 kWh	$298	3534 kWh	168 kWh	$298	25.319 MBtu	117.25	
135	2931 kWh	670 kWh	$288	3491 kWh	164 kWh	$292	24.766 MBtu	115.61	
180	2784 kWh	634 kWh	$274	3493 kWh	164 kWh	$292	24.148 MBtu	113.66	
225	2977 kWh	682 kWh	$293	3592 kWh	169 kWh	$301	25.325 MBtu	117.14	
270	3033 kWh	696 kWh	$299	3522 kWh	168 kWh	$295	25.315 MBtu	117.27	
315	2920 kWh	668 kWh	$287	3539 kWh	168 kWh	$298	24.892 MBtu	115.90	

These results represent the most recent analysis when worst case was checked. For ratings where default appliance values were not used, the energy values will represent the building used for the HERS Score and not the entered building. Select Reports|Annual Simulation to view energy use from the current building.

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Building America
Site Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - std - typical — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Site
Total Space Heating:	7663	0	26.110	612	6677	0	22.784	534	12.7%
Heating:	7064	0	24.068	564	6365	0	21.717	509	
Heating Fan:	599	0	2.042	48	312	0	1.066	26	
Total Space Cooling:	5599	0	19.104	448	3944	0	13.457	316	29.6%
Cooling:	4771	0	16	382	3228	0	11	258	
Cooling Fan:	828	0	2.825	66	716	0	2.443	57	
Total Hot Water:	2902	0	9.903	232	2360	0	8.051	189	18.7%
Lighting Subtotal:	2094	0	7.145	148	2144	0	7.315	152	-2.4%
Wired Lighting:	1726	0	5.888	122	1775	0	6.057	126	-2.9%
Plug Lighting:	368	0	1.256	26	368	0	1.256	26	0.0%
Appliance Subtotal:	5461	0	18.633	436	5460	0	18.629	436	0.0%
Refrigerator:	669	0	2.283	54	669	0	2.283	54	0.0%
ClothesWasher:	105	0	0.358	8	105	0	0.358	8	0.0%
ClothesDryer:	835	0	2.849	67	835	0	2.849	67	0.0%
Dishwasher:	206	0	0.703	16	206	0	0.703	16	0.0%
Cooking:	605	0	2.064	48	604	0	2.061	48	0.2%
Other Appls:	3041	0	10.376	243	3041	0	10.376	243	0.0%
OAVentilation Fan:	187	0	0.636	15	187	0	0.636	15	0.0%
Total:	23895	0	81.530	1891	20772	0	70.874	1641	13.1%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**81.530**	**1891**	**20772**	**0**	**70.874**	**1641**	**13.1%**

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Building America
Source Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - std - typical — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Source
Total Space Heating:	7663	0	82.509	612	6677	0	71.996	534	12.7%
Heating:	7064	0	76.056	564	6365	0	68.627	509	
Heating Fan:	599	0	6.453	48	312	0	3.369	26	
Total Space Cooling:	5599	0	60.367	448	3944	0	42.524	316	29.6%
Cooling:	4771	0	51	382	3228	0	35	258	
Cooling Fan:	828	0	8.927	66	716	0	7.720	57	
Total Hot Water:	2902	0	31.293	232	2360	0	25.440	189	18.7%
Lighting Subtotal:	2094	0	22.577	148	2144	0	23.116	152	-2.4%
Wired Lighting:	1726	0	18.608	122	1775	0	19.142	126	-2.9%
Plug Lighting:	368	0	3.969	26	368	0	3.969	26	0.0%
Appliance Subtotal:	5461	0	58.879	436	5460	0	58.868	436	0.0%
Refrigerator:	669	0	7.213	54	669	0	7.213	54	0.0%
ClothesWasher:	105	0	1.132	8	105	0	1.132	8	0.0%
ClothesDryer:	835	0	9.003	67	835	0	9.003	67	0.0%
Dishwasher:	206	0	2.221	16	206	0	2.221	16	0.0%
Cooking:	605	0	6.523	48	604	0	6.512	48	0.2%
Other Appls:	3041	0	32.787	243	3041	0	32.787	243	0.0%
OAVentilation Fan:	187	0	2.011	15	187	0	2.011	15	0.0%
Total:	23895	0	257.634	1891	20772	0	223.962	1641	13.1%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**257.634**	**1891**	**20772**	**0**	**223.962**	**1641**	**13.1%**

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Appendix 9 Cavalier Standard Typical Output Summaries

Building Input Summary Report

PROJECT

Title:	Southern Energy E6303 - std			Adress Type:	Street Address
Building Type:	User	New/Existing:	New (From Plans)	Lot #	
Owner:	BAIHP / Southern Energy Ho	Bedrooms:	3	SubDivision:	
# of Units:	1	Bathrooms:	2	PlatBook:	
Builder Name:		Conditioned Area:	1732	Street:	
Permit Office:		Total Stories:	1	County:	
Jurisdiction:		Worst Case:	Yes	City, State, Zip:	,
Family Type:	Single-family	Rotate Angle:	270		,
Comment:	STD construction				

CLIMATE

Design Location	Tmy Site	Design Temp 97.5 %	Design Temp 2.5 %	Int Design Temp Winter	Int Design Temp Summer	Heating Degree Days	Design Moisture	Daily Temp Range
LA, Baton Rouge	LA_BATONROUGE	29	93	70	75	1670	51	Medium

UTILITY RATES

Fuel	Unit	Utility Name	Monthly Fixed Cost	$/Unit
Electricity	kWh	Louisiana Average	0	0.08
Natural Gas	Therm	Louisiana Average	0	1.09
Fuel Oil	Gallon	Louisiana Default	0	1.1
Propane	Gallon	Louisiana Default	0	1.4

SURROUNDINGS

Ornt	Type	Shade Trees Height	Width	Distance	Exist	Adjacent Buildings Height	Width	Distance
N	None	ft	ft	ft		ft	ft	0 ft
NE	None	ft	ft	ft		ft	ft	0 ft
E	None	ft	ft	ft		ft	ft	0 ft
SE	None	ft	ft	ft		ft	ft	0 ft
S	None	ft	ft	ft		ft	ft	0 ft
SW	None	ft	ft	ft		ft	ft	0 ft
W	None	ft	ft	ft		ft	ft	0 ft
NW	None	ft	ft	ft		ft	ft	0 ft

FLOORS

#	Floor Type	Exposed Perimeter	Wall Ins. R-Value	Area	Floor Joist R-Value	Tile	Wood	Carpet
1	Crawlspace	177 ft	0	1732 ft²	11	0	0.25	0.75

ROOF

#	Roof Type	Materials	Attic Type	Attic Area	Roof Color	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1in)	Pitch
1	Gable or shed	Composition shingles	Full attic	1732 ft²	Dark	0.96	N	0	300	14 deg

CEILING

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	19	1620 ft²	0.11	Wood
2	Under Attic	6	112 ft²	0.11	Wood

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Building Input Summary Report

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	Width Ft	Width In	Height Ft	Height In	Area	Framing Fraction	Solar Absor.
1	N	Exterior	Frame - Wood	11	57.8	0	8	0	462.4 ft²	0.23	0.8
2	E	Exterior	Frame - Wood	11	15.1	0	9	0	135.9 ft²	0.23	0.8
3	W	Exterior	Frame - Wood	11	25.2	0	9	0	226.8 ft²	0.23	0.8
4	W	Exterior	Frame - Wood	11	4.8	0	8.4	0	40.32 ft²	0.23	0.8
5	S	Exterior	Frame - Wood	11	57.7	0	8	0	461.6 ft²	0.23	0.8
6	E	Exterior	Frame - Wood	11	9.8	0	8.75	0	85.75 ft²	0.23	0.8
7	E	Exterior	Frame - Wood	11	5.1	0	9.25	0	47.17 ft²	0.23	0.8

DOORS

#	Ornt	Door Type	Storms	U-Value	Width Ft	Width In	Height Ft	Height In	Area
1		Insulated	None	0.6	3	0	6.7	0	20.1 ft²
2		Insulated	None	0.6	3	0	6.7	0	20.1 ft²

WINDOWS

#	Ornt	Frame	Panes	NFRC	U-Factor	SHGC	Storm	Area	Overhang Depth	Overhang Separation	Interior Shade	Screening
1		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
2		TIM	Double (Clear)	Yes	0.65	0.67	N	12.5 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
3		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	1 ft 0 in	2 ft 0 in	None	Exterior 50%
4		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
5		TIM	Double (Clear)	Yes	0.65	0.67	N	11.25 ft²	0.75 ft 0 i	2.5 ft 0 in	Drapes/blinds	Exterior 50%
6		TIM	Double (Clear)	Yes	0.65	0.67	N	45.9 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
7	S	TIM	Double (Clear)	Yes	0.65	0.67	N	15.3 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%

INFILTRATION & VENTING

Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50	Forced Ventilation Supply	Forced Ventilation Exhaust	Run Time	Terrain/Wind Shielding
Proposed ACH	0.00036	1623	89.1	167.5	0.250	7.03	24	0	0	Suburban / Suburban

MASS

Mass Type	Area	Thickness	Furniture Fraction
No Added Mass	0 ft²	0 ft	0.3

COOLING SYSTEM

#	System Type	Efficiency	Capacity	Air Flow	SHR	WH Fans	Cross Vent
1	Central Unit	SEER: 13	36 kBtu/hr	1080 cfm	0.75		

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Building Input Summary Report

HOT WATER SYSTEM

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Electric	0.87	40 gal	60 gal	140 deg	None

HEATING SYSTEM

#	System Type	Efficiency	Capacity
1	Electric Strip Heat	COP: 1	29.1 kBtu/hr

SOLAR HOT WATER

Collector Type	Collector Tilt	Azimuth	Surface Area	Loss Coef.	Absorp. Prod.	Trans Corr.	Tank Volume	Tank U-Value	Tank Surf Area	Heat Exch Eff	PV Pumped	Pump Energy

DUCTS

#	Supply Location	Supply R-Value	Supply Area	Return Location	Return Area	Number	Leakage Type	Air Handler	CFM 25	Percent Leakage	QN	RLF
1	Attic	6	346.4 ft²	Crawlspace	86.6 ft²	1	Proposed Qn	Interior	103.92 cf	10.43 %	0.06	0.60

TEMPERATURES

Programable Thermostat: N Ceiling Fans: N

Cooling	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Heating	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec
Venting	[X] Jan	[X] Feb	[X] Mar	[X] Apr	[X] May	[X] Jun	[X] Jul	[X] Aug	[X] Sep	[X] Oct	[X] Nov	[X] Dec

Thermostat Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Cooling (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Cooling (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78

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Building Input Summary Report

APPLIANCES & LIGHTING

Appliance Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Ceiling Fans (Summer)	AM	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.33	0.33	0.33	0.33	0.33
% Released: 100	PM	0.33	0.33	0.33	0.33	0.33	1	0.9	0.9	0.9	0.9	0.9	0.65
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Clothes Washer	AM	0.105	0.081	0.046	0.046	0.081	0.128	0.256	0.57	0.849	1	0.977	0.872
% Released: 60	PM	0.779	0.698	0.605	0.57	0.581	0.57	0.57	0.57	0.57	0.488	0.43	0.198
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dishwasher	AM	0.139	0.05	0.028	0.024	0.029	0.09	0.169	0.303	0.541	0.594	0.502	0.443
% Released: 60	PM	0.377	0.396	0.335	0.323	0.344	0.448	0.791	1	0.8	0.597	0.383	0.281
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dryer	AM	0.2	0.1	0.05	0.05	0.05	0.075	0.2	0.375	0.5	0.6	0.65	1
% Released: 10	PM	0.875	0.85	0.8	0.625	0.625	0.6	0.575	0.55	0.625	0.7	0.65	0.375
Annual Use: 891 kWh/Yr		Peak Value: 200 Watts											
Lighting	AM	0.16	0.15	0.16	0.18	0.23	0.45	0.4	0.26	0.19	0.16	0.12	0.11
% Released: 90	PM	0.16	0.17	0.25	0.27	0.34	0.55	0.55	0.88	1	0.86	0.51	0.28
Annual Use: 1841 kWh/Yr		Peak Value: 601 Watts											
Miscellaneous	AM	0.46	0.47	0.47	0.47	0.47	0.47	0.64	0.71	0.67	0.61	0.55	0.53
% Released: 90	PM	0.52	0.5	0.5	0.5	0.59	0.73	0.79	0.99	1	0.96	0.77	0.55
Annual Use: 2248 kWh/Yr		Peak Value: 412 Watts											
Pool Pump	AM	0	0	0	0	0	0	0	0	0	1	1	1
% Released: 0	PM	1	1	1	1	0	0	0	0	0	0	0	0
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Range	AM	0.057	0.057	0.057	0.057	0.057	0.114	0.171	0.286	0.343	0.343	0.343	0.4
% Released: 100	PM	0.457	0.343	0.286	0.4	0.571	1	0.857	0.429	0.286	0.229	0.171	0.114
Annual Use: 447 kWh/Yr		Peak Value: 165 Watts											
Refrigeration	AM	0.85	0.78	0.75	0.73	0.73	0.73	0.75	0.75	0.8	0.8	0.8	0.8
% Released: 100	PM	0.88	0.85	0.85	0.83	0.88	0.95	1	0.98	0.95	0.93	0.9	0.85
Annual Use: 775 kWh/Yr		Peak Value: 106 Watts											
Well Pump	AM	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.1	0.1
% Released: 0	PM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											

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Appendix 10 Cavalier Standard Perfect Input Summary

Annual Energy Summary

BAIHP / Southern Energy Home — Title: Southern Energy ES303 - std - perfect User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/26/2007 11:39:40

Registration #:

STD construction

End-Use	Energy Consumption	Annual Cost
Cooling (36 kBtu/hr)	2906 kWh	$232
Cooling Fan	669 kWh	$54
Mechanical Vent Fan	0 kWh	$ 0
Total Cooling	**3575 kWh**	**$286**
Heating (36 kBtu/hr)	8403 kWh	$672
Heating Fan/Pump	396 kWh	$32
Mechanical Vent Fan	0 kWh	$ 0
Total Heating	**8799 kWh**	**$704**
Hot Water	4055 kWh	$324
Hot Water Pump	0 kWh	$0
Total Hot Water	**4055 kWh**	**$324**
Ceiling Fans	0 kWh	$0
Clothes Washer	0 kWh	$0
Dishwasher	0 kWh	$0
Dryer	891 kWh	$71
Lighting	1840 kWh	$147
Miscellaneous	2248 kWh	$180
Pool Pump	0 kWh	$0
Range	447 kWh	$36
Refrigerator	775 kWh	$62
Total (kWh)	22630 kWh	$1810
Total (Therms)	0 Therms	$0
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost	—	$1810

* Assumes net metering

Emissions (Calculated as Total - PV Produced)	
SO_2	78.06 Lbs.
NOX	63.15 Lbs.
CO_2	13.42 Tons

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WORST CASE ROTATION - RATING BUILDING ENERGY SUMMARY

BAIHP / Southern Energy Homes — Title: Southern Energy ES303 - std - perfect User — TMY City: LA_BATONROUGE, Elec Util: Louisiana Average, Gas Util: Louisiana Average, Run Date: 12/26/2007 14:24:35

Registration #:

STD construction

	---- Cooling ----			---- Heating ----				HERS	
Rotation	Energy Use	Fan Energy	Cost	Energy Use	Fan/Pump	Cost	Total Energy	Index	e-Ratio
0	2680 kWh	602 kWh	$261	3320 kWh	162 kWh	$279	23.018 MBtu	110.48	
45	2834 kWh	644 kWh	$279	3419 kWh	167 kWh	$287	24.109 MBtu	113.69	
90	2928 kWh	668 kWh	$287	3285 kWh	160 kWh	$276	24.031 MBtu	113.74	
135	2832 kWh	643 kWh	$278	3244 kWh	158 kWh	$273	23.472 MBtu	112.07	
180	2688 kWh	606 kWh	$264	3246 kWh	159 kWh	$273	22.871 MBtu	110.18	
225	2877 kWh	655 kWh	$282	3340 kWh	163 kWh	$280	24.010 MBtu	113.56	
270	2937 kWh	670 kWh	$289	3274 kWh	160 kWh	$275	24.031 MBtu	113.78	
315	2820 kWh	641 kWh	$277	3290 kWh	161 kWh	$276	23.591 MBtu	112.35	

These results represent the most recent analysis when worst case was checked. For ratings where default appliance values were not used, the energy values will represent the building used for the HERS Score and not the entered building. Select Reports|Annual Simulation to view energy use from the current building.

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Building America
Site Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - std - perfect — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Site
Total Space Heating:	7663	0	26.110	612	6377	0	21.757	510	16.7%
Heating:	7064	0	24.068	564	6073	0	20.721	486	
Heating Fan:	599	0	2.042	48	304	0	1.036	24	
Total Space Cooling:	5599	0	19.104	448	3834	0	13.081	307	31.5%
Cooling:	4771	0	16	382	3138	0	11	251	
Cooling Fan:	828	0	2.825	66	696	0	2.376	56	
Total Hot Water:	2902	0	9.903	232	2360	0	8.051	189	18.7%
Lighting Subtotal:	2094	0	7.145	148	2144	0	7.316	152	-2.4%
Wired Lighting:	1726	0	5.888	122	1775	0	6.057	126	-2.9%
Plug Lighting:	368	0	1.256	26	368	0	1.256	26	0.0%
Appliance Subtotal:	5461	0	18.633	436	5460	0	18.629	436	0.0%
Refrigerator:	669	0	2.283	54	669	0	2.283	54	0.0%
ClothesWasher:	105	0	0.358	8	105	0	0.358	8	0.0%
ClothesDryer:	835	0	2.849	67	835	0	2.849	67	0.0%
Dishwasher:	206	0	0.703	16	206	0	0.703	16	0.0%
Cooking:	605	0	2.064	48	604	0	2.061	48	0.2%
Other Appls:	3041	0	10.376	243	3041	0	10.376	243	0.0%
OAVentilation Fan:	187	0	0.636	15	187	0	0.636	15	0.0%
Total:	23895	0	81.530	1891	20360	0	69.468	1609	14.8%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**81.530**	**1891**	**20360**	**0**	**69.468**	**1609**	**14.8%**

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Building America
Source Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - std - perfect — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark kWh	Benchmark Therms	Benchmark MBTU	Benchmark Cost	Prototype kWh	Prototype Therms	Prototype MBTU	Prototype Cost	Savings Source
Total Space Heating:	7663	0	82.509	612	6377	0	68.751	510	16.7%
Heating:	7064	0	76.056	564	6073	0	65.479	486	
Heating Fan:	599	0	6.453	48	304	0	3.272	24	
Total Space Cooling:	5599	0	60.367	448	3834	0	41.337	307	31.5%
Cooling:	4771	0	51	382	3138	0	34	251	
Cooling Fan:	828	0	8.927	66	696	0	7.504	56	
Total Hot Water:	2902	0	31.293	232	2360	0	25.440	189	18.7%
Lighting Subtotal:	2094	0	22.577	148	2144	0	23.116	152	-2.4%
Wired Lighting:	1726	0	18.608	122	1775	0	19.142	126	-2.9%
Plug Lighting:	368	0	3.969	26	368	0	3.969	26	0.0%
Appliance Subtotal:	5461	0	58.879	436	5460	0	58.868	436	0.0%
Refrigerator:	669	0	7.213	54	669	0	7.213	54	0.0%
ClothesWasher:	105	0	1.132	8	105	0	1.132	8	0.0%
ClothesDryer:	835	0	9.003	67	835	0	9.003	67	0.0%
Dishwasher:	206	0	2.221	16	206	0	2.221	16	0.0%
Cooking:	605	0	6.523	48	604	0	6.512	48	0.2%
Other Appls:	3041	0	32.787	243	3041	0	32.787	243	0.0%
OAVentilation Fan:	187	0	2.011	15	187	0	2.011	15	0.0%
Total:	23895	0	257.634	1891	20360	0	219.520	1609	14.8%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23895**	**0**	**257.634**	**1891**	**20360**	**0**	**219.520**	**1609**	**14.8%**

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Appendix 11 Cavalier Standard Perfect Output Summaries

Building Input Summary Report

PROJECT

Title:	Southern Energy E6303 - soff			Adress Type:	Street Address
Building Type:	User	New/Existing:	New (From Plans)	Lot #	
Owner:	BAIHP / Southern Energy Ho	Bedrooms:	3	SubDivision:	
# of Units:	1	Bathrooms:	2	PlatBook:	
Builder Name:		Conditioned Area:	1732	Street:	
Permit Office:		Total Stories:	1	County:	
Jurisdiction:		Worst Case:	Yes	City, State, Zip:	,
Family Type:	Single-family	Rotate Angle:	270		,
Comment:	soffit construction				

CLIMATE

Design Location	Tmy Site	Design Temp 97.5 %	Design Temp 2.5 %	Int Design Temp Winter	Int Design Temp Summer	Heating Degree Days	Design Moisture	Daily Temp Range
LA, Baton Rouge	LA_BATONROUGE	29	93	70	75	1670	51	Medium

UTILITY RATES

Fuel	Unit	Utility Name	Monthly Fixed Cost	$/Unit
Electricity	kWh	Louisiana Average	0	0.08
Natural Gas	Therm	Louisiana Average	0	1.09
Fuel Oil	Gallon	Louisiana Default	0	1.1
Propane	Gallon	Louisiana Default	0	1.4

SURROUNDINGS

Ornt	Type	Shade Trees Height	Width	Distance	Exist	Adjacent Buildings Height	Width	Distance
N	None	ft	ft	ft		ft	ft	0 ft
NE	None	ft	ft	ft		ft	ft	0 ft
E	None	ft	ft	ft		ft	ft	0 ft
SE	None	ft	ft	ft		ft	ft	0 ft
S	None	ft	ft	ft		ft	ft	0 ft
SW	None	ft	ft	ft		ft	ft	0 ft
W	None	ft	ft	ft		ft	ft	0 ft
NW	None	ft	ft	ft		ft	ft	0 ft

FLOORS

#	Floor Type	Exposed Perimeter	Wall Ins. R-Value	Area	Floor Joist R-Value	Tile	Wood	Carpet
1	Crawlspace	177 ft	0	1732 ft²	11	0	0.25	0.75

ROOF

#	Roof Type	Materials	Attic Type	Attic Area	Roof Color	Solar Absor.	RBS	Deck Insul.	Attic Vent Ratio (1in)	Pitch
1	Gable or shed	Composition shingles	Full attic	1732 ft²	Dark	0.96	N	0	300	14 deg

CEILING

#	Ceiling Type	R-Value	Area	Framing Fraction	Truss Type
1	Under Attic	19	1732 ft²	0.11	Wood

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Building Input Summary Report

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	Width Ft	Width In	Height Ft	Height In	Area	Framing Fraction	Solar Absor.
1	N	Exterior	Frame - Wood	11	57.8	0	8	0	462.4 ft²	0.23	0.8
2	E	Exterior	Frame - Wood	11	15.1	0	9	0	135.9 ft²	0.23	0.8
3	W	Exterior	Frame - Wood	11	25.2	0	9	0	226.8 ft²	0.23	0.8
4	W	Exterior	Frame - Wood	11	4.8	0	8.4	0	40.32 ft²	0.23	0.8
5	S	Exterior	Frame - Wood	11	57.7	0	8	0	461.6 ft²	0.23	0.8
6	E	Exterior	Frame - Wood	11	9.8	0	8.75	0	85.75 ft²	0.23	0.8
7	E	Exterior	Frame - Wood	11	5.1	0	9.25	0	47.17 ft²	0.23	0.8

DOORS

#	Ornt	Door Type	Storms	U-Value	Width Ft	Width In	Height Ft	Height In	Area
1		Insulated	None	0.6	3	0	6.7	0	20.1 ft²
2		Insulated	None	0.6	3	0	6.7	0	20.1 ft²

WINDOWS

#	Ornt	Frame	Panes	NFRC	U-Factor	SHGC	Storm	Area	Overhang Depth	Overhang Separation	Interior Shade	Screening
1		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
2		TIM	Double (Clear)	Yes	0.65	0.67	N	12.5 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
3		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	1 ft 0 in	2 ft 0 in	None	Exterior 50%
4		TIM	Double (Clear)	Yes	0.65	0.67	N	22.5 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%
5		TIM	Double (Clear)	Yes	0.65	0.67	N	11.25 ft²	0.75 ft 0 i	2.5 ft 0 in	Drapes/blinds	Exterior 50%
6		TIM	Double (Clear)	Yes	0.65	0.67	N	45.9 ft²	0.75 ft 0 i	1 ft 0 in	None	Exterior 50%
7	S	TIM	Double (Clear)	Yes	0.65	0.67	N	15.3 ft²	0.75 ft 0 i	1 ft 0 in	Drapes/blinds	Exterior 50%

INFILTRATION & VENTING

Method	SLA	CFM 50	ELA	EqLA	ACH	ACH 50	Forced Ventilation Supply	Forced Ventilation Exhaust	Run Time	Terrain/Wind Shielding
Proposed ACH	0.00036	1623	89.1	167.5	0.250	7.03	24	0	0	Suburban / Suburban

MASS

Mass Type	Area	Thickness	Furniture Fraction
No Added Mass	0 ft²	0 ft	0.3

COOLING SYSTEM

#	System Type	Efficiency	Capacity	Air Flow	SHR	WH Fans	Cross Vent
1	Central Unit	SEER: 13	36 kBtu/hr	1080 cfm	0.75		

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Building Input Summary Report

HOT WATER SYSTEM

#	System Type	EF	Cap	Use	SetPnt	Credits
1	Electric	0.87	40 gal	60 gal	140 deg	None

HEATING SYSTEM

#	System Type	Efficiency	Capacity
1	Electric Strip Heat	COP: 1	36 kBtu/hr

SOLAR HOT WATER

Collector Type	Collector Tilt	Collector Azimuth	Surface Area	Loss Coef.	Absorb. Prod.	Trans Corr.	Tank Volume	Tank U-Value	Tank Surf Area	Heat Exch Eff	PV Pumped	Pump Energy

DUCTS

#	Supply Location	Supply R-Value	Supply Area	Return Location	Return Area	Number	Leakage Type	Air Handler	CFM 25	Percent Leakage	QN	RLF
1	Interior	6	346.4 ft²	Interior	86.6 ft²	1	Proposed Qn	Interior	17.32 cfm	1.60 %	0.01	0.60

TEMPERATURES

Programable Thermostat: N Ceiling Fans: N

Cooling [X] Jan [X] Feb [X] Mar [X] Apr [X] May [X] Jun [X] Jul [X] Aug [X] Sep [X] Oct [X] Nov [X] Dec
Heating [X] Jan [X] Feb [X] Mar [X] Apr [X] May [X] Jun [X] Jul [X] Aug [X] Sep [X] Oct [X] Nov [X] Dec
Venting [X] Jan [X] Feb [X] Mar [X] Apr [X] May [X] Jun [X] Jul [X] Aug [X] Sep [X] Oct [X] Nov [X] Dec

Thermostat Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Cooling (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Cooling (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WD)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78
Heating (WEH)	AM	78	78	78	78	78	78	78	78	78	78	78	78
	PM	78	78	78	78	78	78	78	78	78	78	78	78

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Building Input Summary Report

APPLIANCES & LIGHTING

Appliance Schedule: HERS 2006 Reference

Schedule Type		1	2	3	4	5	6	7	8	9	10	11	12
Ceiling Fans (Summer)	AM	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.33	0.33	0.33	0.33	0.33
% Released: 100	PM	0.33	0.33	0.33	0.33	0.33	1	0.9	0.9	0.9	0.9	0.9	0.65
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Clothes Washer	AM	0.105	0.061	0.047	0.047	0.061	0.128	0.256	0.57	0.849	1	0.977	0.872
% Released: 60	PM	0.779	0.698	0.605	0.57	0.581	0.57	0.57	0.57	0.57	0.488	0.43	0.198
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dishwasher	AM	0.139	0.05	0.028	0.024	0.029	0.09	0.169	0.303	0.541	0.594	0.502	0.443
% Released: 60	PM	0.377	0.396	0.335	0.323	0.344	0.448	0.791	1	0.8	0.597	0.383	0.281
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Dryer	AM	0.2	0.1	0.05	0.05	0.05	0.075	0.2	0.375	0.5	0.6	0.95	1
% Released: 10	PM	0.875	0.65	0.6	0.625	0.625	0.6	0.575	0.55	0.625	0.7	0.65	0.375
Annual Use: 891 kWh/Yr		Peak Value: 200 Watts											
Lighting	AM	0.16	0.15	0.16	0.18	0.23	0.45	0.4	0.26	0.19	0.16	0.12	0.11
% Released: 90	PM	0.16	0.17	0.25	0.27	0.34	0.55	0.55	0.88	1	0.86	0.51	0.28
Annual Use: 1841 kWh/Yr		Peak Value: 601 Watts											
Miscellaneous	AM	0.48	0.47	0.47	0.47	0.47	0.47	0.64	0.71	0.67	0.61	0.55	0.53
% Released: 90	PM	0.52	0.5	0.5	0.5	0.59	0.73	0.79	0.99	1	0.96	0.77	0.55
Annual Use: 2248 kWh/Yr		Peak Value: 412 Watts											
Pool Pump	AM	0	0	0	0	0	0	0	0	0	1	1	1
% Released: 0	PM	1	1	1	1	0	0	0	0	0	0	0	0
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											
Range	AM	0.057	0.057	0.057	0.057	0.057	0.114	0.171	0.286	0.343	0.343	0.343	0.4
% Released: 100	PM	0.457	0.343	0.286	0.4	0.571	1	0.857	0.429	0.286	0.229	0.171	0.114
Annual Use: 447 kWh/Yr		Peak Value: 165 Watts											
Refrigeration	AM	0.85	0.78	0.75	0.73	0.73	0.73	0.75	0.75	0.8	0.8	0.8	0.8
% Released: 100	PM	0.88	0.85	0.85	0.83	0.88	0.95	1	0.98	0.95	0.93	0.9	0.85
Annual Use: 775 kWh/Yr		Peak Value: 106 Watts											
Well Pump	AM	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.1	0.1
% Released: 0	PM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Annual Use: 0 kWh/Yr		Peak Value: 0 Watts											

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Appendix 12 Cavalier HSD Input Summary

Annual Energy Summary

BAIHP / Southern Energy Home — Title: Southern Energy ES303 - soffit duct Rated06 — TMY City: LA_BATONROUGE; Elec Util: Louisiana Average; Gas Util: Louisiana Average; Run Date: 12/26/2007 14:38:34

Registration #:

soffit construction

End-Use	Energy Consumption	Annual Cost
Cooling (36 kBtu/hr)	2680 kWh	$214
Cooling Fan	607 kWh	$49
Mechanical Vent Fan	0 kWh	$ 0
Total Cooling	**3287 kWh**	**$263**
Heating (36 kBtu/hr)	2801 kWh	$224
Heating Fan/Pump	153 kWh	$12
Mechanical Vent Fan	0 kWh	$ 0
Total Heating	**2954 kWh**	**$236**
Hot Water	2855 kWh	$228
Hot Water Pump	0 kWh	$0
Total Hot Water	**2855 kWh**	**$228**
Ceiling Fans	0 kWh	$0
Clothes Washer	0 kWh	$0
Dishwasher	0 kWh	$0
Dryer	891 kWh	$71
Lighting	1840 kWh	$147
Miscellaneous	2248 kWh	$180
Pool Pump	0 kWh	$0
Range	447 kWh	$36
Refrigerator	775 kWh	$62
Total (kWh)	15297 kWh	$1223
Total (Therms)	0 Therms	$0
Total (Oil Gallons)	0 Gallons	$0
Total (Propane Gallons)	0 Gallons	$0
PV Produced (kWh)*	0 kWh	$0
Total Cost	——	$1223

* Assumes net metering

Emissions (Calculated as Total - PV Produced)	
SO2	52.76 Lbs.
NOX	42.69 Lbs.
CO2	9.07 Tons

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WORST CASE ROTATION - RATING BUILDING ENERGY SUMMARY

BAIHP / Southern Energy Homes — Title: Southern Energy ES303 - soffit duct User — TMY City: LA_BATONROUGE; Elec Util: Louisiana Average; Gas Util: Louisiana Average; Run Date: 12/26/2007 14:38:31

Registration #:

soffit construction

	---- Cooling ----			---- Heating ----				HERS	
Rotation	Energy Use	Fan Energy	Cost	Energy Use	Fan/Pump	Cost	Total Energy	Index	e-Ratio
0	2426 kWh	646 kWh	$236	2639 kWh	166 kWh	$239	20.369 MBtu	103.19	
45	2582 kWh	663 kWh	$264	2926 kWh	160 kWh	$247	21.341 MBtu	106.09	
90	2872 kWh	604 kWh	$262	2811 kWh	154 kWh	$237	21.301 MBtu	106.21	
135	2582 kWh	582 kWh	$254	2774 kWh	152 kWh	$234	20.785 MBtu	104.66	
180	2450 kWh	550 kWh	$240	2774 kWh	152 kWh	$234	20.226 MBtu	102.91	
225	2617 kWh	591 kWh	$256	2858 kWh	157 kWh	$242	21.239 MBtu	105.91	
270	2880 kWh	607 kWh	$263	2801 kWh	153 kWh	$236	21.301 MBtu	106.23	
315	2572 kWh	580 kWh	$252	2814 kWh	154 kWh	$237	20.888 MBtu	104.91	

These results represent the most recent analysis when worst case was checked. For ratings where default appliance values were not used, the energy values will represent the building used for the HERS Score and not the entered building. Select Reports|Annual Simulation to view energy use from the current building.

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Building America
Site Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - soffit duct — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark				Prototype				Savings
	kWh	Therms	MBTU	Cost	kWh	Therms	MBTU	Cost	Site
Total Space Heating:	7559	0	26.793	605	5476	0	18.684	438	27.6%
Heating:	6962	0	23.754	557	5185	0	17.691	415	
Heating Fan:	597	0	2.038	48	291	0	0.993	23	
Total Space Cooling:	5656	0	19.295	452	3406	0	11.623	272	39.8%
Cooling:	4818	0	16	385	2788	0	10	223	
Cooling Fan:	837	0	2.856	67	618	0	2.110	49	
Total Hot Water:	2902	0	9.903	232	2360	0	8.051	189	18.7%
Lighting Subtotal:	2094	0	7.145	148	2144	0	7.316	152	-2.4%
Wired Lighting:	1726	0	5.888	122	1775	0	6.057	126	-2.9%
Plug Lighting:	368	0	1.256	26	368	0	1.256	26	0.0%
Appliance Subtotal:	5461	0	18.633	436	5460	0	18.629	436	0.0%
Refrigerator:	669	0	2.283	54	669	0	2.283	54	0.0%
ClothesWasher:	105	0	0.358	8	105	0	0.358	8	0.0%
ClothesDryer:	835	0	2.849	67	835	0	2.849	67	0.0%
Dishwasher:	206	0	0.703	16	206	0	0.703	16	0.0%
Cooking:	605	0	2.064	48	604	0	2.061	48	0.2%
Other Appls:	3041	0	10.376	243	3041	0	10.376	243	0.0%
OAVentilation Fan:	187	0	0.636	15	187	0	0.636	15	0.0%
Total:	23858	0	81.403	1888	19032	0	64.937	1502	20.2%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23858**	**0**	**81.403**	**1888**	**19032**	**0**	**64.937**	**1502**	**20.2%**

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Building America
Source Energy Summary 2007

BAIHP / Southern Energy Homes — Project Title: Southern Energy ES303 - soffit duct — Climate: LA_BATONROUGE 12/26/2007

End Use:	Benchmark				Prototype				Savings
	kWh	Therms	MBTU	Cost	kWh	Therms	MBTU	Cost	Source
Total Space Heating:	7559	0	81.505	605	5476	0	59.043	438	27.6%
Heating:	6962	0	75.064	557	5185	0	55.904	415	
Heating Fan:	597	0	6.441	48	291	0	3.139	23	
Total Space Cooling:	5655	0	60.973	452	3406	0	36.727	272	39.8%
Cooling:	4818	0	52	385	2788	0	30	223	
Cooling Fan:	837	0	9.025	67	618	0	6.667	49	
Total Hot Water:	2902	0	31.293	232	2360	0	25.440	189	18.7%
Lighting Subtotal:	2094	0	22.577	148	2144	0	23.116	152	-2.4%
Wired Lighting:	1726	0	18.608	122	1775	0	19.142	126	-2.9%
Plug Lighting:	368	0	3.969	26	368	0	3.969	26	0.0%
Appliance Subtotal:	5461	0	58.879	436	5460	0	58.868	436	0.0%
Refrigerator:	669	0	7.213	54	669	0	7.213	54	0.0%
ClothesWasher:	105	0	1.132	8	105	0	1.132	8	0.0%
ClothesDryer:	835	0	9.003	67	835	0	9.003	67	0.0%
Dishwasher:	206	0	2.221	16	206	0	2.221	16	0.0%
Cooking:	605	0	6.523	48	604	0	6.512	48	0.2%
Other Appls:	3041	0	32.787	243	3041	0	32.787	243	0.0%
OAVentilation Fan:	187	0	2.011	15	187	0	2.011	15	0.0%
Total:	23858	0	257.235	1888	19032	0	205.202	1502	20.2%
Generation(PV):	0	0	0	0	0	0	0.000	0	
Net:	**23858**	**0**	**257.235**	**1888**	**19032**	**0**	**205.202**	**1502**	**20.2%**

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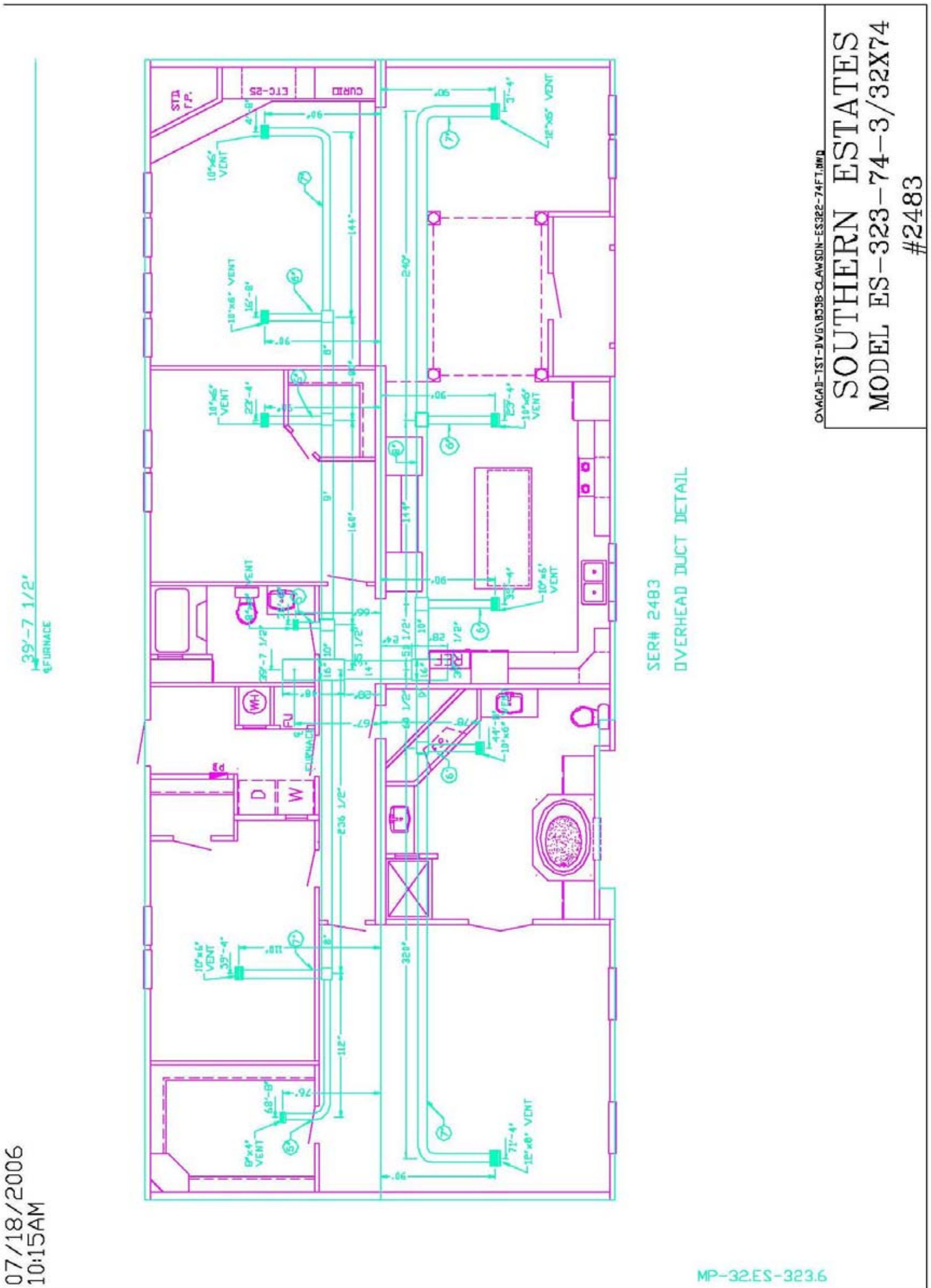
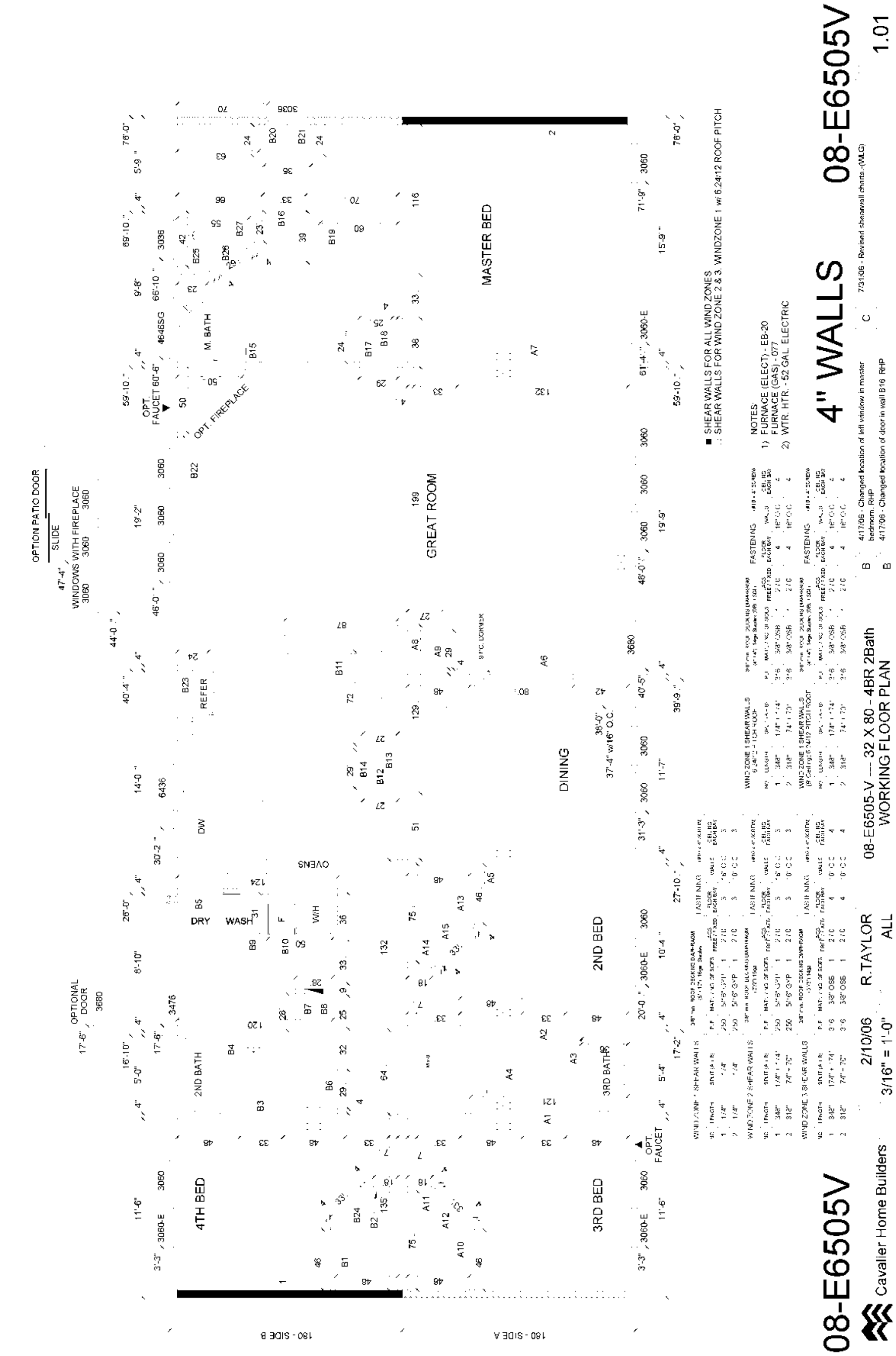
Appendix 13 Cavalier HSD Output Summaries



Appendix 14 Southern Energy Homes Floorplan



Appendix 15 Cavalier Homes Floorplan

References

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