Residential Energy Efficiency Design in New Orleans

BSC Presentation for MIT Course 4.237

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Hot-Humid Climate Design New Orleans, LA

- Building Science Corporation
  - www.buildingscience.com
  - Building technology consulting services
  - Architecture services
  - Consulting with residential builders through the Building America Program
  - Building Science Research projects
  - Forensic Investigations
  - Materials testing
  - Education and training

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- Building America Program
  - www.buildingamerica.gov

U.S. DEPARTMENT OF ENERGY — Building America — U.S. Department of Energy — Research Toward Zero Energy Homes

- "Building America forms research partnerships with all facets of the residential building industry to improve the quality and energy efficiency of homes. The goal is to develop cost effective solutions that reduce the average energy use of housing by 40% to 100%. Ultimately, Building America research will lead to net zero energy homes, which produce as much energy as they use."

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- Hygrothermal Regions

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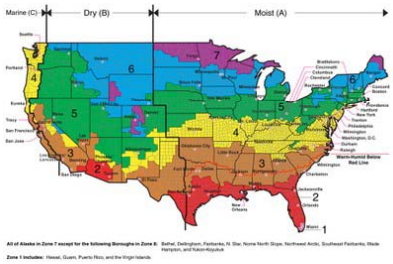
- IECC New orleans is in 2A



Hot-Humid Climate Design New Orleans, LA

- Hot-Humid Climate Definition

A hot-humid climate is defined as a region that receives more than 20 inches (50 cm) of annual precipitation with approximately 6,300 cooling degree days (50 degrees F basis) *[3,500 cooling degree days (10 degrees C basis)]* or greater and where the monthly average outdoor temperature remains above 45 degrees F (7 degrees C) throughout the year.
This definition characterizes a region that is similar to the ASHRAE definition of hot-humid climates where one or both of the following occur:

1. a 67 degree F (19.5 degrees C) or higher wet bulb temperature for 3,000 or more hours during the warmest six consecutive months of the year; or
2. a 73 degree F (23 degrees C) or higher wet bulb temperature for 1,500 or more hours during the warmest six consecutive months of the year.

Hot-Humid Climate Design — New Orleans, LA

- Current Louisiana Projects
  - **Project Home Again: Riggio Foundation**
  - Crescent House: LSU AgCenter
  - Brown House: LSU AgCenter
  - Global Green House


Project Home Again — New Orleans, LA

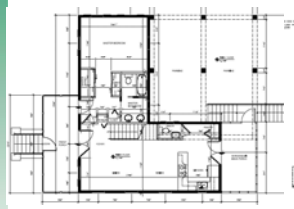
- Project Home Again

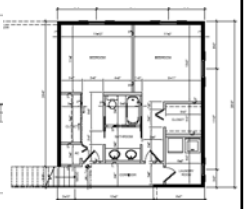

Project Home Again — New Orleans, LA

- Current Status
  - 20 homes total
  - 5 floor plans

Project Home Again — New Orleans, LA

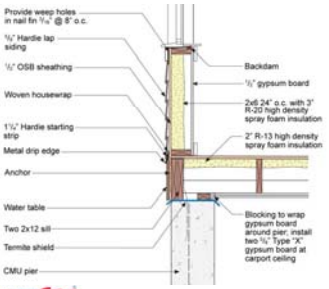
- Design Highlights
  - Compact floor plans (<1600 sf)
  - Focus on spray foam as an air and thermal barrier


Typical First Floor


Typical Second Floor

Project Home Again — New Orleans, LA

- Wall and Floor Building Section



Project Home Again — New Orleans, LA

- Foundation

Project Home Again New Orleans, LA

- Block piers

Project Home Again New Orleans, LA

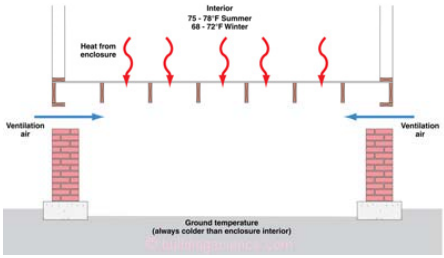
- General Framing

Project Home Again New Orleans, LA

- Floor Framing

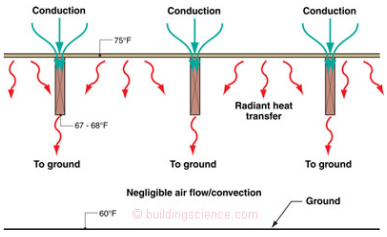
Project Home Again New Orleans, LA

- Condensation Concerns



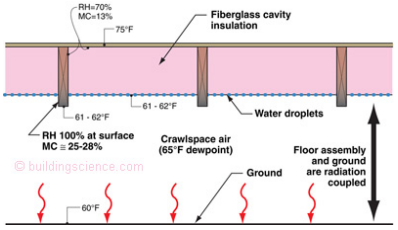
Project Home Again New Orleans, LA

- Condensation Concerns



Project Home Again New Orleans, LA

- Condensation Concerns

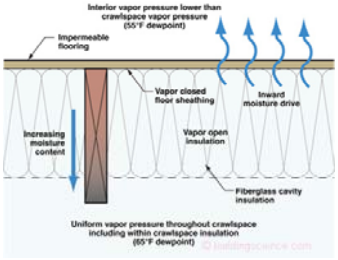


Project Home Again New Orleans, LA

- Condensation Concerns

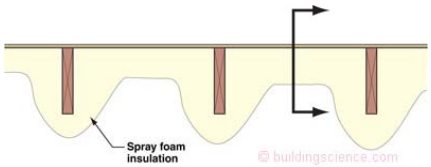
Project Home Again New Orleans, LA

- Condensation Concerns



Project Home Again New Orleans, LA

- Condensation Concerns
  - Should have permeable floor covering to allow for drying to the interior via cooling or supplemental dehumidification



Project Home Again New Orleans, LA

- Crawlspace Condensation Concerns
  - Source – ASHRAE Building Sciences Article
  - "New Light in Crawlspaces"
  - Joseph Lstiburek PhD, P Eng
  - Read it at www.buildingscience.com

Project Home Again New Orleans, LA

- Carport ceiling

Project Home Again New Orleans, LA

- Wall Framing

Project Home Again New Orleans, LA

- Wall Framing

Project Home Again New Orleans, LA

- Wall Insulation

Project Home Again New Orleans, LA

- Wall Insulation

Project Home Again New Orleans, LA

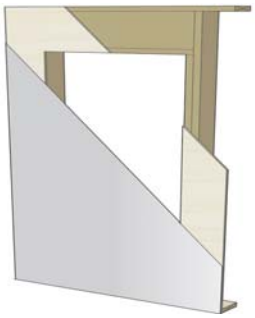
- Housewrap

Project Home Again New Orleans, LA

- Window Flashing

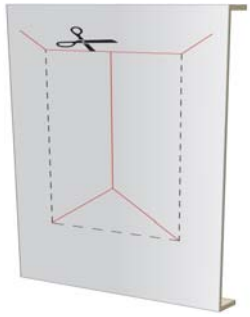
Installing window with housewrap over OSB on a wood frame wall

Step 1
Wood frame wall with OSB and housewrap



Installing window with housewrap
over OSB on a wood frame wall

Step 2
Modified "I" cut in housewrap

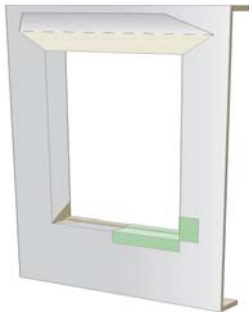


Installing window with housewrap
over OSB on a wood frame wall

Step 3
Fold housewrap in at sill and jambs; housewrap at head temporarily folded up or, alternatively, tucked under; install backdam

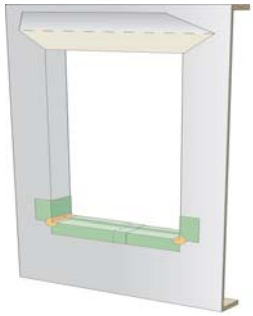
Installing window with housewrap
over OSB on a wood frame wall

Step 4
Install first piece of adhesive-backed sill flashing



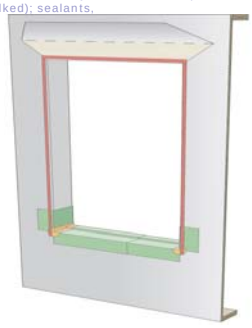
Installing window with housewrap
over OSB on a wood frame wall

Step 5
Install second piece of adhesive-backed sill flashing; Install corner flashing patches at sill



Installing window with housewrap
over OSB on a wood frame wall

Step 6
Apply sealant at window jambs and head; alternatively, sealant can be placed on the back side of the nailing flange (back-caulked); sealants, housewraps and flashings must be chemically compatible



Installing window with housewrap
over OSB on a wood frame wall

Step 7
Install window plumb, level, and square per manufacturer's instructions

Installing window with housewrap
over OSB on a wood frame wall

Step 8
Install jamb flashing first; install drip cap (if applicable); install head flashing

Installing window with housewrap
over OSB on a wood frame wall

Step 9
Fold down head housewrap

Installing window with housewrap
over OSB on a wood frame wall

Step 10
Apply corner patches at head; air seal window around entire perimeter on the interior with sealant or non-expanding foam

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- Housewrap Windows

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- Improper Flashing!

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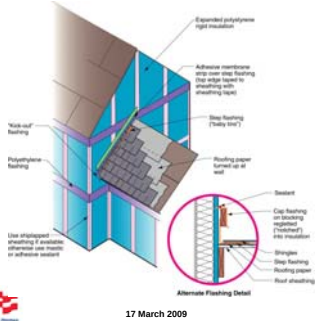
- Inter-roof flashing is paramount



Alternate Flashing Detail

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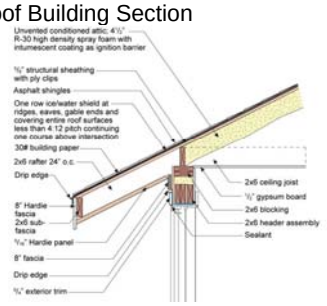
- Roof Building Section



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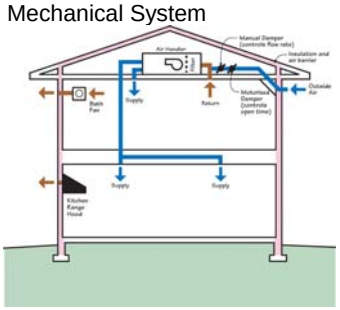
- Unvented Roof

Project Home Again New Orleans, LA

- Unvented Roof

Project Home Again New Orleans, LA

- Mechanical System



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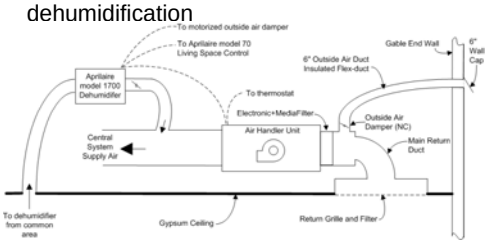
- HVAC system with supplemental dehumidification



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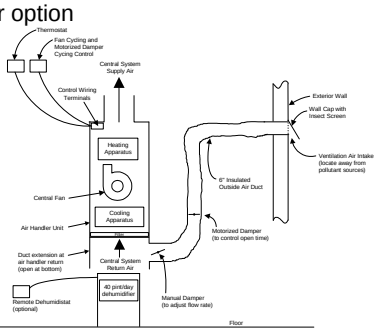
- Another option



Project Home Again New Orleans, LA

- HVAC system

Project Home Again New Orleans, LA

- HVAC system

Project Home Again New Orleans, LA

- Aprilaire Model 1750 whole house dehumidifier

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- 14 SEER / 8.2 Condenser

Project Home Again New Orleans, LA

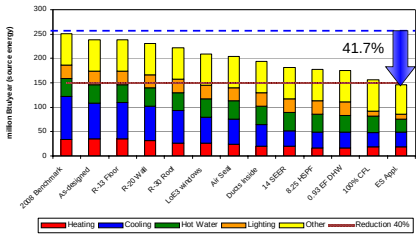
- Finished Installation

Project Home Again New Orleans, LA

- HVAC accessories

Project Home Again New Orleans, LA

- Source Energy Savings 41-43%
- 65-67 HERS Index



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- Source Energy Savings Chart

Parametric Run ID	Description of change	Total Source Energy Savings (H/C/DHW/Lights/Appliances/Plug) over BA Benchmark	Incremental Over Bmrk	Annual energy cost	Item Savings
0	2008 BA Benchmark	n/a	n/a	$2,365	n/a
1	Windows in as-designed locations	5.2%	5.2%	$2,240	$125
2	R-13 HDSF floor	5.1%	-0.1%	$2,242	($2)
3	R-20 2x6 HDSF wall	8.0%	2.8%	$2,174	$68
4	R-30 4.5" HDSF unvented roof	11.5%	3.5%	$2,089	$85
5	U=0.36 SHGC=0.21 windows	16.8%	5.3%	$1,962	$127
6	Air seal to 2.5 Leak Ratio	18.5%	1.7%	$1,921	$41
7	Ducts Inside, 5% leak	22.8%	4.3%	$1,818	$103
8	14 SEER ASHP	27.8%	5.0%	$1,697	$121
9	8.2 HSPF	29.2%	1.4%	$1,664	$33
10	0.93 EF water heater	30.4%	1.2%	$1,636	$28
11	100% CFL Lighting	37.8%	7.5%	$1,482	$154
12	ES Appliances	41.7%	3.9%	$1,388	$94

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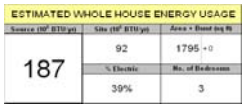
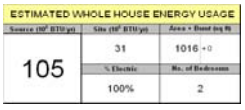
- Source Energy Savings vs. National Average

Estimated Whole House Energy Use Comparison

US Average Mileage Chart



PHA House Mileage Chart



Project Home Again New Orleans, LA

Neutral Cost Analysis

Assumed Financing Rate:	7%
Assumed Financing Term (years):	30

Cumulative Cost	Savings	Annual Finance Cost	Simple cash flow
$7,000	$1,200	$564	$636

Assumptions: 30 year mortgage, 7% interest rate, $0.11/kWh

- **$636 annual net positive cash flow**
  ($1200 annual savings - $564 added mortgage cost)

Project Home Again New Orleans, LA

BSC Building America Quality Control Checklist

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