SIPs and Energy Modeling - Everything Matters

Curt Stendel, Panelworks Plus
Don Jahnke, Extreme Panel Technologies

- In Accordance with the MN Department of Labor and Industry, this presentation has been approved for 1 hour of Continuing Education Credit.


THIS MACHINE SURROUNDS HATE

Do you know the difference between education and experience?

Education is when you read the fine print; experience is what you get when you don't.

Pete Seeger

A Builder's Guide to Structural Insulated Panels (SIPs) For all climates

Joseph Lstiburek

Post World War II Construction

- Architects and Master Builders were the original building scientists
- Architects focused on aesthetics
- Builders focused on finance
- Subcontractors became specialized
- Three important changes
  - Introduction of thermal insulation
  - Development of tighter enclosures
  - Advent of forced air heating and cooling
- Fragmented Design/Build process
- Lack of a systems view to provide predictability and understanding

Energy Modeling

- Performance of building shell components
  - Foundations
  - Walls
  - Roof
  - Windows
  - HVAC options
  - Systems approach

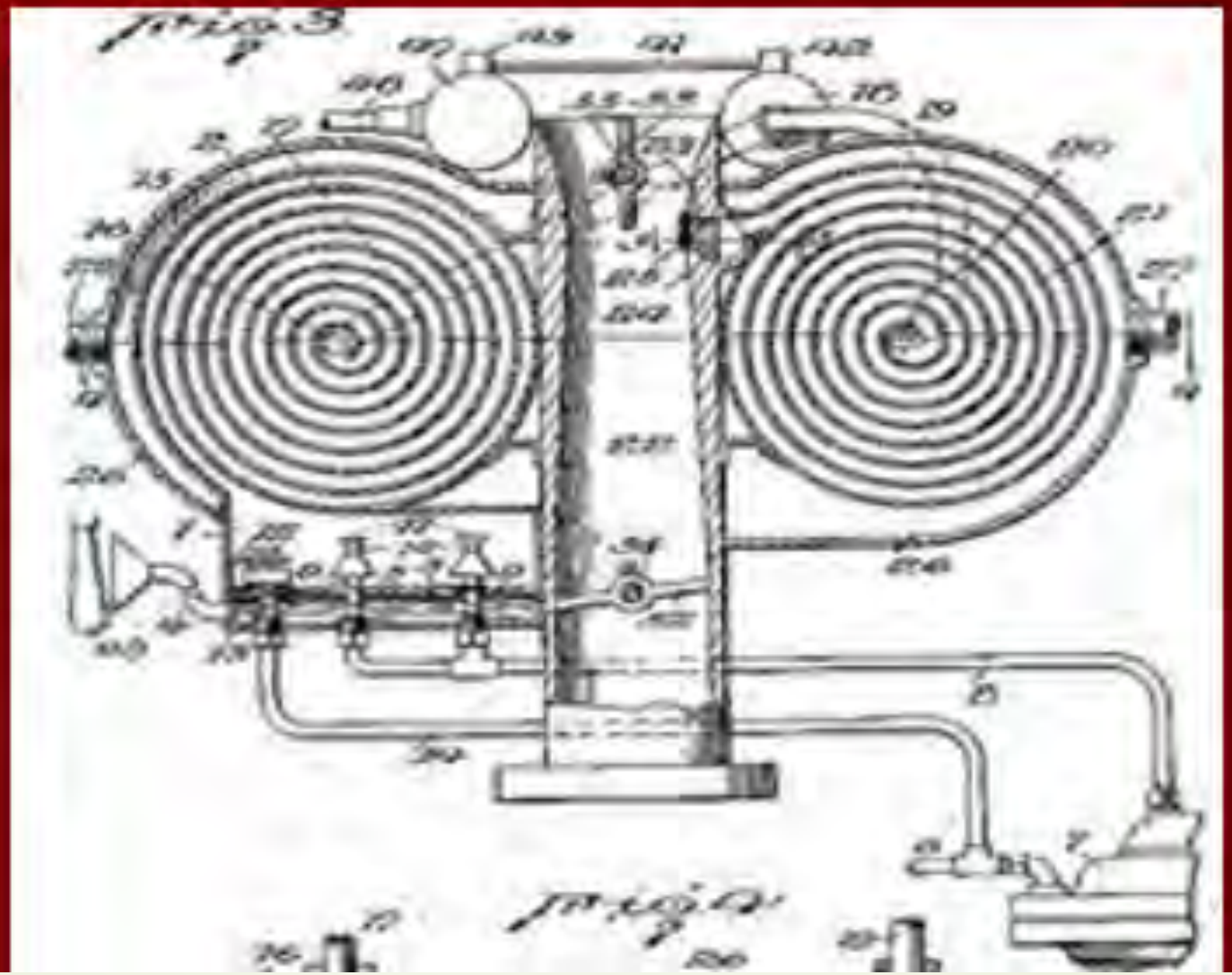
Energy Modeling

- Geography
- Climate
- Directional orientation
- Available fuel options
- Renewable energy
- Occupant lifestyle
- Indoor environment
- Operational costs

Envelope Efficiency

R-Value vs Airtight

100 MPG CARBURATOR



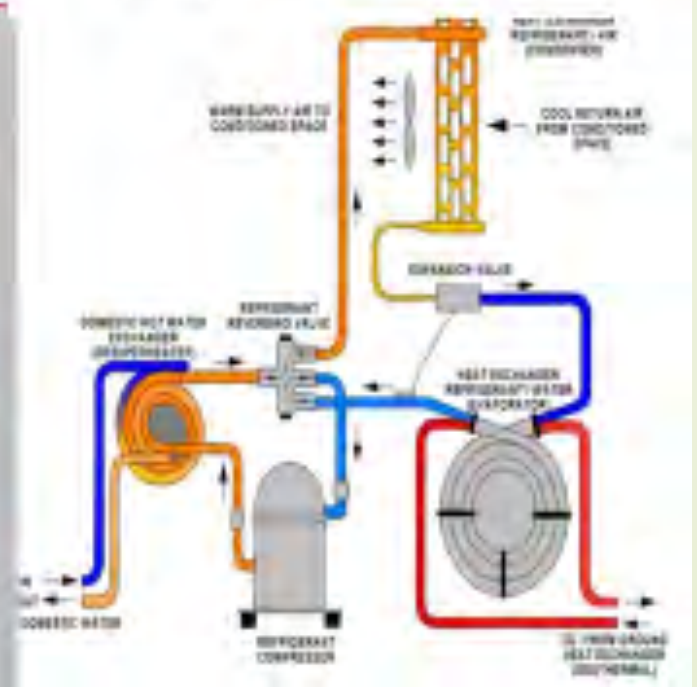
Air flow efficient

Rusty Gas Tank

Equals no gain

- It takes a complete system
- All parts must be compatible to achieve full benefits
- All must be installed correctly
- Sized correctly
- Proven By Testing

Housing Efficiency



Innovative Design

Insulation

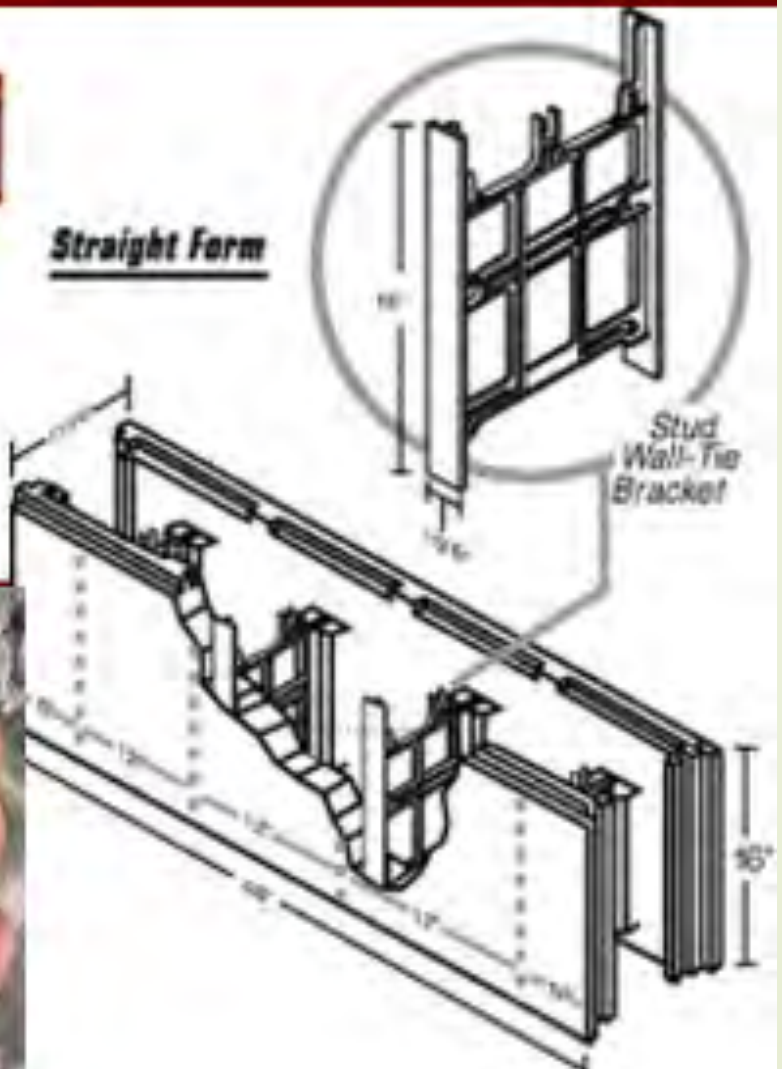
What does it mean to the Homeowner

- Lower Energy Bills
- More Comfortable
- Less Maintenance
- Greener Home
- Better Resale

Case Study

Mechanicals

Construction Materials



Construction Material Specs

- R -22 ICF basement walls
- R-24 SIP panels main floor and Walkout
- R-40 Insulation in Attic
- Windows .29 U Value .19 SHGC
- Air Leakage 187 @ - 50 pascals

ENERGY COST AND FEATURE REPORT - HERS

Date:	July 18, 2012	Rating No.:	
Building Name:	Allan Stangle	Rating Org.:	
Owner's Name:	Allan Stangle	Phone No.:	605-987-2130
Property:	4783 355 th Ave	Rater's Name:	Donald Jahnke
Address:	Ayrshire, IA 50515	Rater's No.:	5739571
Builder's Name:	Todd Morton		
Weather Site:	Sioux City, IA	Rating Type:	Confirmed
File Name:	Untitled.blg	Rating Date:	7-3-2012

ANNUAL ENERGY COSTS	REFERENCE	Allan Stangle	DIFF	% DIFF
Heating	$ 1999	$ 722	$ 1277	63.9%
Cooling	$ 274	$ 81	$ 193	70.5%
Water Heating	$ 481	$ 424	$ 26	9.7%
Lights & Appliances	$ 1045	$ 880	$ 165	16.0%
Photovoltaics	$ -0	$ -0	$	
Service Charges	$ 0	$ 0	$	
Total	$ 3773	$ 2108	$ 1664	44.1%
Average Monthly	$ 314	$ 176	$ 139	44.1%

ENERGY FEATURES		
Ceiling w/Attic:	N/A U=0.030	Rock Blown Attic G1 U=0.026
Vaulted Ceiling:	None	
Above Grade Walls:	N/A U=0.060	2"-SIP R-26 G1 U=0.037
Foundation Walls (Cond):	N/A R=22.0	ICF R-22 G1 R=22.0
Found. Walls (Uncond):	None	
Doors:	N/A U=0.350	Steel Door-urthwlbrk U=0.168
Windows:	UDRH Std U=0.350	And400vinatrhsn U=0.290
Frame Floors:	None	
Slab Floors:	N/A U=0.365	SLAB & PERIMeter Rad U=0.365
Infiltration:	Htg: 0.00048 Clg: 0.00048 SLA	Htg: 187 Clg: 187 CFM/hr
Infilt. Measure:	Blower door test	
Mechanical Ventilation:	None	Balanced: HRV, 90 cfm, 67.0 watts
Interior Mass:	None	
Mech Equip List:	ASHP: Htg: 114.7 kBtu/h, 7.7 HSPF. Clg: 60.1 kBtu/h, 13.0 SEER.	ASHP: Htg: 84.3 kBtu/h, 8.5 HSPF. Clg: 28.4 kBtu/h, 18.0 SEER.
	Water Heating: Conventional, Elec, 0.88 EF.	Water Heating: Conventional, Elec, 0.92 EF.
Programmable Thermostat:	Heat=No, Cool=No	Heat=Yes, Cool=Yes
Ducts:	NA	Uninsulated Conditioned basement
Duct Leakage to Outside:	NA	8.00 CFM @ 25 Pascals
Total Duct Leakage:	NA	80.00 CFM @ 25 Pascals
Lights/Appliances:	Defaults	

AIR LEAKAGE TEST RESULTS

Date of Test: 7-3-2012 Test File: MortonAyshire

Test Performed For: Allan Stange
4789 369th Ave
Ayrshire, IA 50515
Phone

Test Results

1. Measured Leakage: **13 sq. in. (187 CFM @ 50 Pa)**

   This leakage area represents the cumulative size of all holes and cracks in the exterior of your house through which unconditioned outside air enters your home and conditioned air escapes.

2. Est. Annual Air Change Rate: **0.06 air changes/hour (0.0 CFM/person) ***

3. Est. Cost of Air Leakage: **$ 11 per year (heating and cooling) ***

Ventilation Guideline

ASHRAE Standard 62.2 recommends minimum ventilation requirements for residential buildings to maintain acceptable indoor air quality. Based on the results of this airtightness test, Standard 62.2 recommends that a whole building mechanical ventilation rate of **46 CFM** be continuously provided in this building. **

Additional Information

If some of the house leakage is located in the forced air duct system, both the leakage rate and energy costs will tend to be higher than reported above. Duct leaks result in much greater air leakage because they are subjected to much higher pressures than typical house leaks. Duct leaks can also seriously degrade indoor air quality.

Many factors contribute to indoor air quality including ventilation rates, sources and locations of pollutants, proper operation of combustion appliances and occupant behavior. Additional testing is needed to fully evaluate the air quality in your house.

* The estimated annual air change rate is based on ASHRAE Standard 136-93 and assumes no mechanical ventilation. Actual air change rates and costs may differ from these estimates by a factor of 2 or more.

** ASHRAE Standard 62.2 also contains requirements for local kitchen and bathroom mechanical exhaust systems. These local exhaust systems may be incorporated into a whole building ventilation strategy. Consult Standard 62.2 for more information on ventilation strategies and specific requirements and exceptions contained in the Standard.

Heat Pump

- 1200 cfm fan - rated
- 22 feeds to house
- 2 returns 8x8 and 10x10-connected to 2 6″ round pipes
- 5″ pleated filter- cut airflow 300cfm
- 4 registers no air movement
- Ran continuous 3 months 175.00/month
- 14 degree temp range across house

Corrections

- Added 3 more returns
- Dampered down multiple feeds with balancing dampers where possible
- Cut Temp difference to 4 degree variable
- Operating cost to 28.00 / month

Testing Critical

- Tested airflow
- Duct design
- Duct Sealing
- Duct Blast
- Manual J
- Manual S
- Blower Door

What We Find Typical

- Less than ½ air flow to house
- Air-to-Air balanced less than 1%
- Comfort issues
- Oversized Air Exchange
- Poor Duct design and installation
- Few HVAC options

Opportunities for Options

- Net Zero PV or net 80
- Solar thermal radiant and domestic
- Envelope strategies-mixed technologies
- Controls for air exchange-humidity based
- Radiant options elec-gas-wood-solar-floor-ceiling
- Zoned Systems- up to 40% more savings

But I'm not Building New

- What can testing tell us on existing homes
- Does what we find direct the fixes
- Do the results always have predetermined results
- Can you still determine the value of fixes
- Do you have to make them all at once

Fix the Problems

- It is not the same problem on all houses
- But most houses have the same problems- air leakage-poor balanced HVAC-temp swings across the house which = high utility bills and low comfort
- Air is always trying to come in the bottom and go out the top should always try to fix both

Case Study

To Start With

- 1600 sq ft 1200 main 400 second floor
- Basement is 20x20 in middle of the house
- Crawl space both ends block and stone
- Windows replaced with vinyl replacements in 1994
- 20k spent on energy efficiency in 2004
- Blown cellulous in walls -8" fiberglass batts in floor system
- Natural gas furnace circa 1965

Testing

- 12.5 ACH at -50 pascals
- 30% RH

Typical Advice

- New HVAC
- New Windows
- Blow Insulation in walls
- Insulate the Attic

Fixes and Results

Fixes & Results

- First 4 ft of nailbase cut leakage to 4.1 ACH @ -50
- Rest of house cut it to .95 ACH @ -50
- New Boiler with radiant heat
- Insulate dirt floor in crawl Space to lower RH as it went to 65%
- Left all windows
- Bill from 125.00 to 33.00/mnth average

Blower Door Testing & Thermal Imaging


DG-700 Pressure & Flow Gauge
DEVICE
CONFIG
- 50.2
318
MODE
TIME AVG
DEVICE
UNITS
CONFIG
MODE
CLEAR
TIME AVG
BASE LINE
START
ENTER
INPUT
ON/ OFF
LIGHT
HOLD
The ENERGY CONSERVATORY
HIGH
OFF


3532


FLIR
29.4 °F
222
57
23
12:00:04 p e=0.48 Trefl=68


FLIR
57.5 °F
222
68
35
12:17:47 p e=0.48 Trefl=68


FLIR
50.2 °F
222
68
35
12:25:15 p e=0.48 Trefl=68

Build Tight
Ventilate Right

- Homes cannot be built too tight – but they can be under ventilated!

HERS Index
Home Energy Rating Score

- Score indexed between 0 – 100
- Energy Conservation Code = HERS 100
- Energy Star = Less than HERS 80
- Net Zero Energy Home = HERS 0

HERS Before Renewables

- Zero is not possible without renewable energy produced on site
- Renewables DO NOT equate to efficiency!
- Real energy efficiency is a function of conserving energy not producing energy.

Goals

- Test All products before rebates
- Look at alternative Energy Savings options before choosing
- Base decisions on testable ROI
- Ask as many questions to determine qualifications of a contractor
- Develop long and short term goals on existing projects

Form vs. Function

- Does it have to look like this to be efficient?

Or is this better?







Tyvek

Common Denominator

- All less than $100.00 per month utilities
- Was not an Accident
- Was a Building Science trained contractor
- All homes were tested and inspected throughout construction for efficiency and code

How Long Does It take To Pay Back?

- Tax Credits vs. Taxable Deduction
- What is the baseline from Modeling?
- Forget percentages of improvement without individualized data
- Should be close to day 1
- Look at it monthly for cost data (It might be a $2,000.00 per month mortgage payment with $300.00 per month utilities or $2,200.00 mortgage with $100.00 per month utilities-which is better).
- Facts: Utility costs will continue go up over the next 30 years and are not tax deductible.

It All Matters

- No decision is unaffected by others
  - better insulation = lower hvac needs
  - flooring types can be affected by humidity levels
  - range hoods affect airflow
- Every Action has a Reaction
- Someone has to take the lead on the project -- A GOOD GC is PRICELESS
- Every subcontractor must have a design that works with other equipment on the project
- Have regular construction meetings for progress of your new home

Getting ready for 2012 IECC

- Continuous Insulation
- Air Sealing
- Manual J – BTU demand
- Manual S – Sizing
- Blower Door & Duct Blast testing
- Building Leakage must be less than 3.0 ACH/50pa
- All of these and more easily accomplished with SIPs

Conclusion

- All systems can work if designed and installed correctly
- Consider different options in there entirety for the project specifically
- Find qualified installers
- Pay for testing-cheap insurance
- Collaborate knowledge where possible

Life is Short --
Let's get started!