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To receive one AIA/CES HSW credit, read ***5 Common Myths About Energy* (p 13); *Net-Zero Construction* (p 32) *and Lateral Bracing at Top of Wall Provides Critical Connection* (p 38)** then complete the questions below.

**DIRECTIONS** | Select one answer for each question in the exam and circle the appropriate letter. A minimum score of 80% is required to earn credit. Valid for credit through December 2014.

**1 When a wall doesn't have a floor or roof near the top of the wall, a designer must come up with alternatives for lateral support, such as**

a) Horizontal trusses spanning between the bearing walls.
b) Extra vertical reinforcement near the top of the wall.
c) Additional lateral bracing at the base of the wall.
d) All of the above

**2 Proper reinforcement and detailing significantly reduces structural damage, better protecting occupants and property**

a) True b) False

**3 Reinforced walls are not susceptible to failure as a result of high wind loading.**

a) True b) False

**4 A floor or roof spanning between shear walls and resisting horizontal wind loads is known as**

a) Simple support
b) A cantilever
c) A diaphragm
d) A moment

**5 Building codes that include provisions for resiliency may**

a) Protect property
b) Protect lives
c) Provide more durable buildings
d) All of the above

**6 The effectiveness of added wall insulation diminishes as the amount of wall insulation increases.**

a) True b) False

**7 Increasing the insulation in the walls of a 2000 sf single story home located in Orlando from R4 masonry to R20 ICF saves what amount on your yearly power bill?**

a) $79
b) $450
c) $1070
d) $2200

**8 For the Florida climate it is always cost effective to place the insulation on the exterior of a block wall.**

a) True b) False

**9 All power companies are required to purchase energy back from the customer at retail energy prices.**

a) True b) False

**10 Increasing the insulation in the walls of a 2000 sf single story home located in Orlando from R4 masonry to R20 ICF saves installing how many 270 watt PV panels?**

a) 2
b) 5
c) 12
d) 18

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FLORIDA MASONRY APPRENTICE & EDUCATIONAL FOUNDATION

# MASONRY & NET-ZERO

## THE PERFECT MATCH

By Don Beers, PE

**AIA / CES Learning Objectives**

* Understand how Net Zero is achieved in a residential home.
* Understand the relationship between energy use and PV panel size and number.

## What the Heck is "Net Zero"?

In a nutshell – no energy bill for the life of your home --- Hurray! Your house generates all the energy you use. The concept is simple and pretty easy to understand. The general public has gotten "Net Zero" and other more exotic green technology pretty well mixed up in their minds.

Net Zero starts with an energy efficient house. Add an array of PV (photovoltaic) solar panels on the roof that turn sunlight directly into electricity, control the collection and distribution of that energy into your home electrical circuits and finally (and this is extremely important) sell your excess electricity back to the power company hopefully at the same retail rate you pay for it when you buy it from them!

During the sunny parts of a typical Florida day, when you are generating more energy than you are using in your home, "net metering" basically turns your power meter backwards and your PV panels become your private power generation station. There is no magic giant battery that has been developed to date that can store this excess energy. Consequently, the "extremely important" factor in making "net zero" work is that the power company is willing to purchase your home generated power at the same rate that they sell you power. See insert "Selling Excess Energy Back to the Power Company".

## I thought that solar panels were too expensive for the typical home owner?

The price of solar panels, like all technical products, is becoming more affordable every year. With the current pricing of panels, energy rates, etc. the investment in PV or photovoltaic panels is about a break-even. It's like paying for 30 years of your home's electric bills with your initial mortgage. Also, if the price of energy continues to rise, you're protected from skyrocketing energy bills.

The cost of a typical "net zero" array of PV panels depends on a bunch of factors: size of your home, energy efficiency of your home, climate, personal use, type of panel, etc., etc., etc. Currently a very rough general range would be from \$20,000 to \$35,000[1] in the blazing Florida sunshine.

But, cost aside, the neat part that is making "net zero" so popular is how clean the energy is that you will be using for the life of your home. Sunlight to electricity is about as clean as it gets. This has a real attraction for those wishing to be more environmentally conscious. It also adds permanent value to your home as the warranted life of most panels is 25-30 years.

## Why is the masonry industry interested in energy efficient "net zero" residential construction?

Concrete masonry walls are superior in every measurable way and give the best value for cost of any residential Florida building system. This is particularly true in the area of energy efficiency. Unfortunately, not everyone is aware of the benefits of concrete block homes. The exterior wall market is extremely competitive and energy efficiency is becoming a key factor in the home buyer's decision on what home to purchase. The "net zero" home is the logical extension of this widespread concern over energy costs and the effect of carbon based energy sources on the environment.

As we see in the article on the PNNL energy study (see pg. 13) masonry homes ARE energy efficient and, in addition, the exterior walls don't have a major impact on the overall energy usage of the typical residential home. This does not stop competitive wall sys-

[1] *Please see Florida PNNL Energy Report. Www.floridamasonry.com*

tems from making wildly exaggerated claims as to the energy benefit of their particular system.

In determining how to achieve a "net zero" home, the builder has a vested interest in understanding how much PV panel is going to be required to satisfy his energy usage. It is a perfect opportunity to showcase the cost effectiveness of concrete masonry in designing and building energy efficient homes.

We see builders across Florida regularly using, or considering the use of, unnecessary, overly expensive, highly insulated wall systems in the belief that it is the only way to conserve energy. It is the responsibility of the concrete masonry industry to get the truth out concerning exterior walls. The promotion of "net zero" homes provides a platform for an honest discussion of conserving energy using the information obtained in the PNNL study (currently the best information available on the influence of wall insulation).

## Can I Do that With a Block Home?

In **Example 1** we calculated the upfront cost of PV panels required to power a typical block home with R4 insulation. This home energy analysis comes from the PNNL study and incorporates the current code requirements for energy efficient residential construction. We know that there are many areas of the house that can be improved on above the code minimums but the question becomes "which ones are a sound $$ investment".

The 40 panels at a cost of $32,400 (**see Example 1**) do the job for our energy code compliant block house with R4 insulation in the walls. As we improve the energy efficiency of the home, our electricity use will come down and we will be able to achieve "net zero" with fewer panels – at a cost savings of approximately $3/watt. For a 270 watt panel this works out to $810/panel - installed - wired – complete.

(The actual savings in reducing a 40 panel array, by say 3 or 4 panels, is really less than $810/panel as this cost includes some electrical switching equipment required regardless of the number of panels and some fixed costs for mobilization of installation and electrical crews. The actual panel cost is around $1/watt or $270/panel. To be conservative in our comparison and for the sake of simplicity we will just stick with the $3/watt or $810/panel.)

An ICF salesperson would tell you that there are substantial savings in your PV panel requirements by changing from a block to an ICF wall system. It would just be common sense that making an igloo cooler out of your home would be worth every penny in achieving your "net zero" goal. But hold on one second. With the data from our PNNL study we can see EXACTLY how much you will save[2].

Calculating the reduction in panel requirements in going from an R4 masonry wall to an R20 ICF wall system (at an increased cost of $4000 plus[3]) we find that we reduced the 270 watt panel requirements from 40 panels to ...38 panels. A whopping 2 panel reduction at a conservative, maximum possible savings of $1620.

For $4000+[3] in extra wall insulation you achieve a maximum savings of $1620 in PV panels. This is not a bargain, nor would most people do this if they knew the facts. A slight increase in block wall insulation for $400 to $500 dollars would probably decrease your panel requirements to 39 panels. This is a potential trade off that might be worth your while. Turning the walls of your home into an igloo cooler is not.

**Example 1 -Calculated cost of PV panels on a typical 2000 sf masonry home in Central Florida** (built to PNNL listed prototype requirements, R4 insulation in masonry walls, single story, PNNL analysis #18737)

- Total yearly electric use – 15,498 KWh
- Required Daily PV panel output = 15,498/365=42.5 KWh/day
- Accepted standard daily output of 270 watt panel (panel produces 270 watts of energy in full sunlight, 4 hours of full sunlight per day used as standard in Florida) 270 X 4 / 1000= 1.08 KWh/day.
- Required PV panels to produce enough electricity to power the house – 42.5/1.08=39.3 panels or 40 panels.
- General panel cost – installed – wired - complete - is around $3/watt. (40) 270 watt panels would cost 40 X 270 X $3 = **$32,400** – POOF – No more electric bill!!

**Example 2 -Calculated cost of PV panels on a typical 2000 sf ICF home in Central Florida** (built to PNNL listed prototype requirements, R20 insulation in 6 inch concrete walls, single story, PNNL analysis #21401)

- Total yearly electric use – 14,779 KWh
- Required Daily PV panel output = 14,779/365=40.5 KWh/day
- Accepted standard daily output of 270 watt panel (panel produces 270 watts of energy in full sunlight, 4 hours of full sunlight per day used as standard in Florida) 270 X 4 / 1000= 1.08 KWh/day.
- Required PV panels to produce enough electricity to power the house – 40.5/1.08=37.5 panels or 38 panels.
- General panel cost – installed – wired - complete - is around $3/watt. (38) 270 watt panels would cost 38 X 270 X $3 = **$30,780** – a $1620 savings over R4 block construction.

## Selling Excess Energy Back to the Power Company

**Check With the Utility Company**

First, contact your utility company to see if they will allow you to connect a solar system to their electrical grid. While there is a national law that requires investor owned utility companies to allow interconnection of a solar power system, rural electric cooperatives are exempt from this law.

**Buy Back Rate?**

If your utility company will allow you to connect your PV system to their grid, then ask is if they will buy the energy back at the retail or wholesale rate. Ideally you want the utility company to buy back any excess electricity at the retail rate.

**Net Metering or Not?**

This arrangement is called "net metering" and is the simplest way to setup a grid-tie PV system. In such a system you only have one utility kWh meter (kilowatt-hours) and it is allowed to spin in either direction depending on if you are buying or selling energy. In a non-net-metered system, the utility company will require that you install a second kWh meter. It records any excess energy that you sell back to them. They will only pay you the wholesale rate which is usually only a few cents per kWh.

**Check Your State Regulations On-Line**

To find out if your State offers "net metering" go to www.dsireusa.org . The "net metering" law for Florida doesn't apply to rural electric cooperatives so call your utility company.

# Continuing Education


**Insurance Institute for Business & Home Safety (IBHS) Research Center performed a high-wind test of commercial masonry structures to determine design and construction best practices. High winds caused roof up-lift, pulling bond beam from top of unreinforced wall, leaving no horizontal support.**

## Research confirms resiliency of structural masonry in major wind events

# Best Practice Lateral bracing at top of wall provides critical connection

Don Beers, PE

**Masonry can be the best wall system available for resisting high winds and preventing damage to structures. The weight and stability of the concrete masonry unit (CMU) or structural brick combined with the grouted rebar connections throughout the wall give masonry a unique ability to stand up to high wind pressures, even pressures far in excess of the calculated design loads. For masonry, and any other type of wall, one of the essential requirements for resistance to horizontal wind load is support by a roof or elevated floor at the top of the wall (referred to as diaphragm action). Walls with lateral support at the top and the bottom are called *simply supported* as opposed to *cantilevered* walls, which have no horizontal support at the top.**

The tall, unsupported cantilevered wall acts as a lever creating torque (high bending forces at the bottom) which tries to push the wall over, or if the connection to the foundation is strong enough, tries to overturn the foundation. This torque at the base is referred to by engineers as an *overturning moment*. The *moment* being simply a rotational force. This *moment* action has to be resisted by a large foundation with enough weight to resist the overturning and creates excessive bending *moment* in the lower area of the wall. The bending moment in a cantilevered wall is four times the bending moment in a wall of equivalent height braced (*simply supported*) at the top for horizontal (*lateral*) wind loads.

Structural engineers and builders understand

- masonry walls taller than 4' or 5' must be designed as cantilevers or be supported at both the top and bottom.
- cantilevered walls taller than 8' usually require special oversized foundations and additional vertical reinforcement at the base of the wall.
- walls above 15' in height are not usually cantilevered because of very large foundation and heavy reinforcement necessary to handle the overturning and bending moment.

Photo courtesy of Masonry Association of Florida

**While this wall was well reinforced, there was no tie in between the vertical wall reinforcement and the bond beam. When the winds of Hurricane Andrew blew, both roof and wall failed and the building's interior was demolished.**

**LEARNING OBJECTIVES**

CONTINUING EDUCATION AIA

**Upon reading the article you will be able to:**

1. Explain the importance of lateral support at the top of walls in commercial and residential structures.
2. Identify code requirements for exterior wall support and designer responsibility in meeting requirements.
3. Compare the performance of commonly-built structures and those built using best practices for resisting high wind loads

## IBHS Testing Gives Graphic Illustration of the Impact of Side Wall Connection

The Insurance Institute for Business & Home Safety (IBHS) is dedicated to research and training as related to the evaluation of residential and commercial construction materials and systems. Research performed at their test center is used to justify revisions to building codes and practices toward more resiliency in the built environment and a reduction of the cost to the public in both lives and property lost as a result of natural disasters.

In an effort to compare and contrast performance of typical commercial strip mall-type construction with that of construction using best practices, IBHS tested two 30' x 20', single-story structures side by side in their wind tunnel facility in Chester County, South Carolina. Associations affiliated with the building envelope (including walls, roof and doors) were consulted.

**Best Practice vs Common Practice.** Because of their experience with masonry structures in high wind, both in theory and practice, IBHS approached the Masonry Association of Florida and the National Concrete Masonry Association (NCMA) for help in designing masonry walls for the two side-by- side commercial buildings. One of the buildings (called *Common*) was to contain the most common practices of masonry construction, many of which include doing things *as they have always been done*. The second building (called *Stronger*) was to be built according to best practices and current design code requirements. The assembled design team agreed on four key differences in the two wall designs (see table page 38).

The virtual lack of continuity of the wall vertical reinforcement into the bond beam and poor connection to the roof in the *common* building was the primary failure area. Indeed, the *Common* building failed in the wind test in the exact mode I have seen played out in wind storms across Florida. The vertical reinforcement in the wall of the *Common* building lacked adequate connection to the bond beam. Consequently, the net roof up-lift of approximately 45 to 50 psf pulled the bond beam away from the top of the wall leaving no horizontal support for the wall. It had little capacity since it was not designed to act as a cantilevered wall and thus had little means to resist the approximately 35 psf of wall net wind pressure.

The top wind gust during the test was 136 mph, or the equivalent of a 97 mph one-minute sustained wind speed. *All wind speeds are referenced to standard open country conditions at an elevation of 10m (33')* (Exposure C in wind code terms).

Results indicate that **proper reinforcement and detailing significantly reduce structural damage, which in turn, protects occupants and property.** This is especially important to the insurance industry as their research indicates that one in four businesses that close during a disaster does not repair their facilities and reopen. This can have disastrous repercussions on the economy, as small businesses are vital, occupying 30-50% of all commercial space and accounting for 54% of all sales in the US, according to the Small Business Administration.

**One in four businesses closed due to disaster does not repair facilities and reopen**

Portions of the test can be online seen at **disastersafety.org/high_winds/commercial-high-wind-test-resources/**. Of all the masonry building designs I have ever been involved with, this is the only one that was built to be blown down!

## Most Vulnerable Structures

Churches, gymnasiums, box retail stores, warehouses and other structures with walls above 10' in height and a single span roof system are at increased risk from high winds. Where cast-in-place floors and roofs lock in the exterior walls, the problem is much less likely. However, every exterior wall must be properly connected into the structure at the top and bottom for best performance.

After Hurricane Andrew made landfall in Florida in 1992, we observed some classic failures due to lack of connection. Large doors are vulnerable in high winds. If the large door fails on the windward side, increased pressure develops inside the building and may blow out the side wall, particularly with a lack of connection between the wall and pre-stressed roof. This type of collapse would likely completely demolish the interior of the structure.

We encountered a church structure exposed to winds in the Category 2 hurricane range (96-100 mph sustained wind speeds). The collapsed wall was connected to the roof structure with a cut nail every 48", which was obviously provided during – and for –construction, not for lateral support.

Pictured is an endwall of a warehouse structure. While the wall was very well reinforced, there was no tie in between the vertical wall reinforcement and the bond beam (sound familiar?)

| | Common Building | Stronger Building |
|---|---|---|
| **Amount of Vertical Reinforcement** | Contained #4 vertical reinforcement on both sides of openings and in the corners | Added #4 vertical reinforcement at maximum spacing of 8' on center along all walls |
| **Connection of the bond beam to the vertical wall steel (Primary failure area)** | No hook bars extended into the bond beam. Vertical bars were allowed to extend into the bottom of the bond beam ¼" | 90° hook bars extended fully into the bond beam and extended down into the wall to lap with vertical wall steel |
| **Corner bars for continuity of reinforcement in bond beams around corners** | No corner bars were used in bond beams | Corner bars in bond beams were used to fully connect walls together at the top corners |
| **Bond Beam Depth** | Used an 8" deep bond beam at the top of the wall | Bond beam depth was increased to 16" (two courses). Both courses contained (2) #4 bars in top of ach course |

**IBHS research construction practice criteria used in erecting Common and Stronger buildings for high wind testing.**

## Best Practices

Both the IBC and the MSJC call for lateral support at the top of the wall. Section 1.7.4.1 of TMS 402-08 states, "Walls, columns and pilasters shall be designed to resist loads, moments and shears applied at the intersections with horizontal members". The location and number of these structural elements are obviously left up to the designer, but their presence is essential, as we have seen, to the wind load resistance of the structure.

**Communication.** Early and regular collaboration and communication between members of the design team, construction team and inspectors can reinforce the importance of proper connection to structural elements to prevent lateral connections from being overlooked.

**Detailing.** Designers often have a floor or roof near the top of the wall to act as lateral support (diaphragms). Without one, solutions are not immediately obvious. For some large open structures with tall walls, I have gone to the extent of creating horizontal trusses spanning between the bearing walls. In other cases, long tall walls may require regular vertical pilasters spanning between the foundation and roof diaphragm with the wall spanning horizontally between these members.

**Acting on the big picture is always better than a short-term savings.**

Another common oversight happens when the engineer of record assumes that the wall to roof connection is being detailed by roof supplier. Again, this can be resolved by early and open communication between parties.

**The Big Picture.** Bearing wall connections to the roof are generally not where the issue arises, because there has to be some type of connection to hold the roof in place. Not so for the non-bearing walls. Special brackets or odd connectors attaching the roof and top of the endwall (non-bearing) may be ignored simply as a cost-saving effort without clear understanding of how critically important to the survival of the structure the connectors are. **The IBHS study showed, however, that while a building may perform acceptably under normal conditions without those connections, the time and cost of rebuilding after a storm or earthquake is exponentially more expensive than the original savings were worth. And you run the risk of human injury or loss of life as a result.** Acting on the big picture, for the long term, is always better than a short-term savings.

**Checks and Balances.** Without some foreknowledge by the inspector on the importance of proper roof-to-wall detailing, he may miss checking for this when work is in progress. After construction, the connection areas may not be obvious or be hidden from view, especially if 20' or 30' off the ground, so verifying their placement may be difficult after the fact. Again, early communication and planning can help ensure not only that the work is being executed properly, but that it will be inspected for accuracy and verified.

## Is Residential Exempt?

Unbraced gable endwalls in smaller, single-family homes fair no better than their commercial counterparts. A standard failure mode is wind on the leading edge of the roof pries up decking, trusses progressively collapse into the structure, and the endwall, with no lateral bracing, collapses into the structure also. It is instructive to note that during the development of the Florida wind codes, the arguments over the proper bracing of the gable end were the most contentious and animated. Subsequent wind storms have ended the argument. Bracing of the gable endwall is essential! The solution is either adequate bracing of the gable endwall back into the roof structure or balloon framing where the endwall spans from the foundation all the way up to the underside of the roof decking (roof diaphragm including proper connection).

## The Answer

Masonry design has made incredible advances in both design codes and computerization. Real-life failures are often from a simple omission. Not providing lateral support at the top of all walls is an easy-to-understand and easily correctable mistake, not only in masonry construction but in all construction types. Sadly, it is also the most common and unnecessary masonry failure mode I have seen from Florida hurricanes and tornados.

**Don Beers**, PE, GC, is currently the staff engineer for the Masonry Association of Florida and President of Adrian Engineering Services. Beers was Engineering Services Manager with Rinker Materials for 29 years. He has served as Chairman of the National Concrete Masonry Association's Codes Committee, the Florida Concrete & Products Association's Block Committee and on the Board of The Masonry Society (TMS). He is also a member of ASTM, Florida Engineering Society, National Society of Professional Engineers, ASCE, ACI and TMS. Beers is a graduate of the University of South Florida in Civil and Structural Engineering and is a licensed engineer and general contractor in Florida.
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# 5 COMMON MYTHS ABOUT **ENERGY**

By DON BEERS
MAF ENGINEER

01 **MYTH #1** Putting heavy insulation in your walls can save you hundreds of dollars PER MONTH – FALSE!

02 **MYTH #2** More insulation is always better - FALSE!

03 **MYTH #3** R13 wood walls are much more energy efficient than R4 CMU – FALSE!

04 **MYTH #4** Insulation is only effective on the outside of CMU – FALSE!

05 **MYTH #5** R4 masonry is not energy efficient enough for use in the North Florida climate – FALSE!

CONTINUING EDUCATION AIA

## LEARNING OBJECTIVES:

- Understand what the PNNL energy study is and what information can be obtained from it.
- Learn the truth, as exposed in the PNNL research, about 5 Florida energy myths concerning concrete masonry.

energy research

# 5 COMMON MYTHS ABOUT ENERGY

This article is a brief introduction to the energy research recently completed by Pacific Northwest National Laboratories (PNNL) and funded by the Masonry Association of Florida (MAF) and the National Concrete Masonry Association (NCMA). This research is ground breaking – but not astounding. The masonry industry would certainly have preferred it showed wild increases in the value of thermal mass across all climate zones. However, it did confirm the value of mass that researchers have verified over the past 40 years on energy use in residential structures. This is, in essence, a very good thing as it also means the research over the past 40 years validates this recent research. Combined with the technical force of PNNL; the proven validity of Energy Plus™ modeling software used in the research; and the carefully documented research development, there is little room for doubt or dissension. In other words the results are rock solid – and favorable to high mass wall systems.

The results are groundbreaking in the breadth and scope of the walls compared - 607 different combinations of concrete masonry units (CMU), wood and insulated concrete forms (ICF). Almost every conceivable arrangement of standard building products compared "apples to apples" across every climate zone in the US. It leaves nowhere to hide.

Additionally, the research is leading edge in that it moves us past discussions of "R" value to the ability to see the actual kWhs (and thus $$) differences between walls with varying mass, insulation levels and insulation arrangements. It brings all discussions on insulation levels into clear monetary focus, putting it in the correct perspective. Quadrupling the insulation in your walls sounds great until you find out that it only saves you a mere $100 a year and will never give you payback for the first cost of the higher R value wall!

The data base is huge – nearly 22,000 individual analyses were run. Thousands of energy use comparisons can be made on various wall types and climate zones. This article discusses five eye-opening truths that specifically relate to Florida's climate and building types. The PNNL research gives the REAL answer to residential energy questions that have plagued masonry for the past four decades. To read the detailed Florida report or the full PNNL Research, please go to the Masonry Association of Florida website: www.floridamasonry.com.

"There are things I always wanted to know about energy and masonry but could never find the real answer."

**Q** What do you REALLY save when you insulate the bajeebers out of the exterior walls of a typical Florida home?

**A** **The real answer (as opposed to all of the ridiculousness floating around the internet)**

Super high R value wall systems don't pay for themselves anywhere in the Florida climate. The maximum dollar savings that can be achieved by changing the insulation of the exterior walls in a 2000 sf one story home is roughly $100 per year. That's it. And that is NOT going to pay for the $4000 plus dollars it is going to take to do it. *[See Table 1—Page 15]* Table 1 was generated from the PNNL data and clearly shows the HVAC savings when you change out the walls from R4 CMU to R20 ICF. The overall U value is - well – the overall U value. There isn't room for a detailed answer in this article for U stuff so just consider it the insulation value of the wall with the smaller number having the better insulation. What is clear is that approximately four times the insulation value nets you precious little dollar return. In Miami, where we have the largest difference, your igloo cooler wall insulation gets you the equivalent of a Starbucks Frappuccino and lemon pound cake a month. In Orlando you'll have to pass on the lemon pound cake.

**Q** As you continue to increase insulation in the exterior walls of a Florida home is there an optimum level beyond which you are just wasting your money?

**A** **The Real Answer (as opposed to what your local insulation salesman is going to tell you)**

In Florida your return on exterior wall insulation starts to diminish rapidly. I always knew this was generally true – but I now know EXACTLY how it is true. Insulation beyond the R4 to R8 range for mass exterior walls is a complete waste of money. *[See Figure 1—Page 15]* Figure 1 shows the savings for various levels of insulation. Going from no insulation to a nominal R4 in Miami

*Pictured above: Residence @ 13th Street. 2010 Masonry Excellence Awards Winner—Residential. Central Broward Construction. www.cbcfl.com* makes perfect sense. It costs around $240 and saves you $70 or so per year. Going from R4 insulation to R8 insulation is a marginal return of around $53/year on an initial investment of $770 for the upgraded insulation package. Increasing your insulation from R8 to R20 costs you around $4000 and nets you a whopping additional $48 per year of energy savings. This is a straight payback of over 80 years and not worth the investment no matter how you crunch the numbers.

**Q** Are R13 wood frame homes really that much more energy efficient than an R4 masonry home?

**A** **The real answer (As opposed to what your local wood distributor will tell you)**

The energy efficiency of CMU with R4 insulation and wood walls with R13 batt insulation is neck and neck across Florida. Table 2 shows the real HVAC energy savings in Miami, Orlando and Jacksonville. Wood edges out CMU in Miami at $46/year but this lead reduces to $15/year in Orlando. $15 per year ($1.25 per month) is for all practical purposes a dead heat (your monthly allotment is down to free coffee at Publix and a donut.)

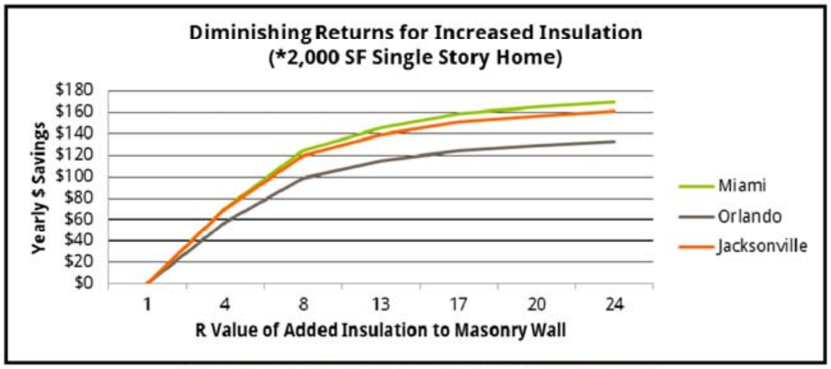
**Q** Can masonry homes with R4 insulation be energy efficient in Jacksonville with the cold winter weather?

**A** **The real answer (Not what you hear from the track wood frame builders in Jacksonville)**

We were surprised that mass did not perform better in Miami but elated at how close CMU came to wood in Jacksonville - $18/year difference – nearly as good as Orlando. (See Table 2) When you factor in the moisture/mold degradation of wood's batt insulation over time we are back to what we always knew – CMU, with a minimum of insulation, is very energy efficient everywhere in Florida! In addition, insurance for wood frame homes costs $150 to $575 (10-20%) more annually than CMU masonry homes, more than offsetting any incremental energy savings by 10 to 30 times.

| Total Energy $ Savings per Year Over Standard CMU w/R4 Added Insulation (2000 sf Single Story Home) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wall# | Wall | Overall R Value | $ Savings in Miami | $ Savings in Orlando | $ Savings in Jax | Cost of Energy Upgrade | Payback Period for Mia |
| 1 | CMU R4 | 5.8 | 0 | 0 | 0 | 0 | 0 |
| 3 | ICF R20 | 21.7 | $101 | $79 | $96 | $4,207[5] | 41.5 yrs |

*[Table 1: Comparison of Energy Savings of the Least and Most Insulated Walls in Florida]*




*[Figure 1—Diminishing Returns for Increased Insulation]*

| Total Energy $ Savings per Year Over Standard CMU w/R4 Added Insulation | | | | | |
|---|---|---|---|---|---|
| Wall# | Wall | Overall R Value | Miami | Orlando | Jax |
| 11 | CMU R4 | 5.8 | 0 | 0 | 0 |
| 12 | 4" Wood R13 | 10.9 | $46 | $15 | $18 |

*[Table 2 - Energy Differences Between R4 CMU and R13 Wood Walls]*

| Total Energy Savings per Year of Exterior Insulation over Interior Insulation | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wall# | Wall | Overall R Value | Miami | Orlando | Jax | Cost of Exterior Insulation[10] | Payback Period for Jax |
| 13 | CMU Int Insul | 10 | 0 | 0 | 0 | 0 | 0 |
| 14 | CMU Ext Insul | 10 | $14 | $17 | $22 | $3366 | 153 yrs |

*[Table 3 - Comparison Savings of Interior vs. Exterior Insulation - CMU]*

**Q** Do you have to put the insulation on the exterior of a mass wall in order for it to be effective??

**A** **The real answer (Not what you get from self-appointed energy gurus)**

As we knew from past research, exterior insulation is more efficient; however, this research allowed us to look at the actual cost savings. Table 3 is a direct comparison of the same wall with the only difference being insulation on the interior or the exterior of the wall. The research data shows that indeed, exterior insulation is more energy efficient but only at around 4 to 6 cents per day.

At this small savings exterior insulation is just not feasible. The interior insulation location currently being used in almost all CMU walls looks very cost effective. This is a 40-year discussion item solved for Florida – keep the insulation on the inside of the wall.

The comparisons presented in this article were chosen to highlight the amount of bad information and confusion associated with them. When it comes to energy it seems like everyone has a product to sell or a personal "green" perspective to promote. The

## 5 Common Energy Myths (continued)

real value of this research is being able to quickly and easily get to the cost vs value relationship between virtually all wall systems. Not having the actual yearly dollar differences between walls leaves too much room for exaggeration and the imagination. "If no one knows - then anything goes" and myths on energy efficiency abound:

- Putting heavy insulation in your walls can save you hundreds of dollar PER MONTH – **FALSE!**
- More insulation is always better – **FALSE!**
- R13 wood walls are much more energy efficient than R4 CMU – **FALSE!**
- Insulation is only effective on the outside of CMU – **FALSE!**
- R4 masonry is not energy efficient enough for use in the North Florida climate – **FALSE!**

The energy data from the PNNL research will certainly be dissected by those depending on exaggerated claims of energy savings.

The force of this research is that no better information is currently available – **anywhere.**

## THE REST OF THE STORY

In addition to energy efficiency CMU has tremendous advantages. Unlike wood walls, CMU is unaffected by water and is not a food source for mold – no rot, no mold and no deterioration over time. Because it does not burn, your home insurance rates for CMU are 10 - 20% lower than for wood homes. Generally, this results in a savings of $150-$575 per year for insurance alone. Structurally, CMU has proven far superior to wood in hurricanes and wind storms. CMU is unaffected by the catastrophic termite damage to wood structures in Florida. And, getting back to energy, the minor differences in Table 2 are quickly reversed with moisture deterioration of batt insulation over time (the average rainfall in South Florida is 60 inches per year).

Masonry is the proven system for building Florida homes. For 60+ years masonry has quietly dominated the market of exterior wall building systems – for many good reasons – energy efficiency not the least. The masonry industry undertook this comprehensive study to forcefully counteract the wild claims being promoted in the residential construction arena. Added to these untruthful claims is the increasingly accepted notion that any amount of energy savings is worth any cost. Knowledge is power and hopefully, with the knowledge provided by this research, home buyers can make an educated decision on the best building material for their new home – concrete masonry.

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