

NC Home Grabs Five Green Ratings



By Michael Chandler | November 2, 2009



Wide (37 in.) roof overhangs and lattice shade structures protect windows from the summer heat. The three roof-mounted solar collectors are connected to a 180-gallon storage tank which supplies hot water to the radiant floor.
Image Credit: Michael Chandler, Chandler Design-Build

LEED Silver, Energy Star, Builders' Challenge, a Gold rating from a local green program, and pending LEED for Homes certification make this house a green building rating system handbook

UPDATED 2/23/2011 with floor plans, details, and an energy use graph
Although I've been building green homes for 30 years, I joined the certification game only five years ago. I've gained so much from the feedback provided by the Energy Star Homes program and the NAHB Green Building Initiative that I decided to dive right in to help create the new

National Green Building Standard (NGBS, also known as ANSI-700 or NAHB-Green).

I've been wanting to make a point about what I see as unproductive tension between the NAHB and the USGBC over the relative greenness of the two systems. Recent discussions with USGBC partisans encouraged me to enroll a house in multiple certification programs, including LEED for Homes, NGBS, and Energy Star. To provide further comparisons, for a modest addition cost we also certified to a local program, "Green Home Builders of the Triangle," and to the DOE Builders' Challenge.

With documentation from four programs in hand, and a fifth (LEED for Homes) pending, I braved the arduous application process for the Energy Value Housing Awards and came up a winner there as well.

Different rating programs have surprising similarities

After going through this exercise, my sense is that there were more similarities than I was expecting. I thought that LEED would penalize me more than it did for building in an area where sorting and weighing the construction trash is not affordable. I was also unaware of the points NGBS would have given me for it.

NGBS gave me lots of credit for features that enhance durability, whereas LEED gave only a limited number of points for creating and implementing a durability plan. I didn't do any "point chasing" for LEED or NGBS other than adding a few more jumper ducts than we normally would have and offering the homeowner free 1.28 GPF toilets to prevent the installation of 1.6 GPF units that she had picked up at a plumbing supplier's "going out of business" sale. The Builders' Challenge program encouraged us to install carbon monoxide detectors. Other than that, I just built to our normal quality standard. The house ended up scoring LEED Silver and NGBS Gold.

It seems to me that NGBS rewards builders for making an organized effort to take actions towards sustainability, while LEED holds builders to higher standards for planning and documentation. Much of the documentation required by NGBS can be done with a digital camera; LEED requirements for documentation and inspection seem more stringent.

Jamie Hager, my verifier from Southern Energy Management, helped me understand and interpret the LEED program. The useful NGBS Web site provided clear explanations, minimizing the need for a consultant.

Calculating certification costs

It cost me about \$650 in certification costs to comply with the Energy Star and Builders' Challenge programs. Adding the NGBS report card cost me about \$650 more, and the LEED cost me about \$1,950 more.

In the future I'll continue to certify all my homes to Energy Star and NGBS but will only certify my very highest performing homes to LEED. This is in keeping with LEED's goal of being the certification of choice for the very highest performing homes in America. It seems to me that there is no cause for tension here.

Double-stud walls are the least expensive

Vicky and Jonathan Bryant, who both come from England, asked us to design a house with autoclaved aerated concrete (AAC) walls. They thought that thick AAC walls would recreate the feelings evoked by the thick stone walls of their childhood. While I had some concerns about the lack of a drainage plane and the window and door installation details, we went ahead and priced the house three ways: AAC, insulated concrete forms (ICFs), and double-stud walls.

The double-stud system saved them \$30,000 over the AAC and \$15,000 over the ICF (part of which may have been due to lack of competition in those trades). It cost us \$4,200 to upgrade from our standard 2×6 energy-framed walls to double-stud R-46 Spider-insulated walls — \$2,400 for the 2×12 top plates and non-load bearing interior wall panels and \$1,800 for the additional insulation thickness.

We wrapped the radiant slab with 9-in termite-resistant PolySteel ICFs. The building inspector wouldn't accept the exterior 2×4 wall bearing only 2 inches on the concrete, so we had to increase that wall to a 2×6 with a 2 1/2-in. purlin at the midpoint connecting it to the interior 2×4 wall panel.

Stucco done right

Hoping to evoke memories of thick stone walls, we specified stucco cladding. However, we didn't want to extend the stucco right up to the windows and

doors; we wanted to have access in the future in case a window needed maintenance. By trimming the aluminum-clad windows with fiber-cement-board trim, we left easy access to the Tyvek tape and window nailing flanges.

Since Jonathan Bryant is a managing director of BASF Plant Science, he hoped to get special pricing on their very nice synthetic stucco products. In the end, however, the cost of the BASF system couldn't compete with our local masons who are accustomed to traditional hard-coat stucco. Because the mason's bid for lath preparation was high — and because I prefer to have tight control on the drainage plane installation and protection — our crew installed the housewrap and flashing details. We used non-metallic SpiderLath, a product with rubber gaskets running vertically to seal the nail penetrations (6 in. o.c. each way). The lath was installed to comply with guidelines faxed to us by the Jacksonville (Florida) Building Inspections Department.

Panelized walls are strong and go up fast

We had the wall panels delivered sheathed with 1/2-in. OSB. The stringent OSB nailing specs provide hurricane resistance (it's not the wind, but the flying trees that are the problem in this part of the state). The OSB was fastened 3 in. o.c. at the panelization plant (Builders First Source) using a computer-driven sheathing stapler.

We wrapped the walls on-site with Tyvek Wrinkle Wrap. We then taped the window flanges and electrical penetrations and lapped and taped the step flashings. We applied a weep screed along the bottom of the wall, integrated with our galvanized termite flashings.

Once this was all watertight we covered the Tyvek with two layers of #15 asphalt felt and then the SpiderLath. The stucco crew covered the lath with a two-coat 3/4-in.-thick layer of type-S stucco. The moisture of the first coat caused the asphalt felt layers to wrinkle and create a drainage space in front of the Tyvek. The second coat was applied and smoothed after the first was fully hardened. The stucco was then painted with an elastomeric paint to seal it and allow us to touch up scratches and dings in the future if needed.

Planning for accessibility

The Bryants wanted to have a master bedroom on the second floor but also wanted the house to include “aging-in-place” details and to be handicapped visitable so their parents could easily come to stay.

Our designer, Beth Williams, included a comfortable first-floor bedroom with a bathroom designed to be walker-accessible. We saved money by having the first-floor bathroom open to the hall just outside the guest bedroom, so it could double as a powder room.

Taking advantage of the sun

On the roof we installed three solar thermal collectors from our local solar collector manufacturer, Solar H2OT. The system was designed in collaboration with their lead engineer, Dan Gretch, and local radiant floor guru, Roy Schmidt. We used a 160-gallon unpressurized storage tank from STSS as the drain-back tank for the system. The tank has an internal heat exchanger for the domestic hot water and another for the radiant floor.

The space heating system Roy designed includes an outdoor reset mixing valve that adjusts the temperature of the water in the floor in response to the temperature outside the house. As the temperature outside warms up the temperature of the water entering the floor is reduced and a cold evening triggers a warmer water temperature to the floor. Even with a three-panel system we still need an efficient back-up heater; we chose the 94% efficient Quietside 120-ODW natural gas condensing on-demand water heater which we were able to purchase for less than \$1,200.

Lessons Learned

The double-stud system was a big success for us, but I would pay more attention to the door strikes next time. We packed out the dividers between the front door and its sidelights too much; as a result, the door latch has left a black line where it rubs against the interior trim.

Too much foundation foam makes for a skeptical inspector. Next time I’ll be more proactive in getting my engineer behind the double 2x4 wall system so I don’t have to go to 2x6 exterior wall panels. And I may compromise by using a 2x10 upper top plate rather than a 2x12. The big benefit as I see it is the 2.5 in. thermal break between the walls stuffed full of Spider fiberglass insulation.

The solar storage tank was a headache. The 160-gallon SSTS solar tank is an unpressurized EPDM-lined tub-style tank that comes knocked down and has to be assembled on site. The synthetic rubber liner had a toxic powder on it that caused one of my workers to get quite ill for two days due to exposure during assembly. The fact that the tank doesn't seal all that well and is full of very hot water has led to excessive humidity in the tank room. In the future I'll stick with a large conventional water heater tank or two. I think I could install two 120-gallon Solar Pro tanks for the installed cost of the 160-gallon SSTS tank, with a lot fewer headaches (it would be close though).

Tyvek and asphalt felt can be partners. While I feel comfortable with the stucco system we used — I did a lot of research on it — I still prefer red cedar shingles for an exterior siding material. But I'm sold on putting a layer of asphalt felt over the Tyvek regardless of the siding to defend it from surfactants in the siding material and give a dedicated drainage path between the tarpaper and the Tyvek. It took little time or money and I really feel it will enhance the long-term performance of the wall. Sort of a variant on my foundation rule, "Install the best waterproofing you can afford, and then don't let it get wet!"

The integration of the galvanized termite flashing and the galvanized weep screed at the top of the ICF slab was more challenging than I expected. Our blower-door test came in at 1.75 ACH @ 50 Pascals, which, while respectable, is a far cry from our previous house which tested at 0.70. I think the difference lies in that detail. I'll continue to line my radiant slabs with the PolySteel ICFs, but I'll pay more attention to getting that seal tighter.

Roof garden gets a thumbs up. The roof garden has been an unqualified success. We built a rubber roof with scuppers and a hurricane drain and then floated a brick floor 1/2 in. above it on Ameridrain drainage mats and flashed that layer into the wall flashing to keep the rubber roof from getting wet. The Bryants have plans to establish a serious vegetable garden up there away from the grazing deer. We installed a water spigot for tending the lettuce and tomatoes as well as a gas outlet for their barbecue grill. Just walking out onto that area is magical. I'll do it again as soon as I can find a client for it.

The gutter-fed rain garden was cost-effective. All the gutter flow was collected in rain gardens buried under the ornamental planting beds and under

the vegetable garden so that the collected water could just soak up through the soil into the roots above it.

This was amazingly economical — about \$260 per rain garden more than trenching the storm water to the neighbor's property line — and it gained us a positive landscape feature.

Further energy savings will be challenging. With the walls at R-46 and 8 in. of foam in the roof, zoned bypass dehumidification and cooling, solar-assisted floor heat and U-0.30 / 0.30 SHGC windows with exterior shading, we seem to be at a point where further energy improvements are getting exponentially more expensive.

The obvious next step is to seriously question the benefit of every square foot of glass — to work on reducing glazing area while still giving clients the living experience they want. Beyond that we'll be looking at ultra-high-performance windows and the cost/benefit of installing even deeper foam in the roof.

I do think we've moved beyond the HERS software, which is why we're spending the money (over \$3,000) to have third-party energy monitoring done on this project to see if there are any lessons to be learned there that may inform our next move. At the same time I'm going back to past homes we've built and getting propane and electric usage records to look for trends and patterns there.

A great team. While the features of this home were a lot of fun for me, and while I am proud of its green rating scores and energy performance, I have to give a lot of credit to my crew, especially Chris Kersher and Mat McDonald who pulled it all together.

It has been a blessing to work with such enthusiastic clients. Jon Bryant did all the computer and smart-home wiring, and Vicky Bryant, who works as an interior designer, sourced all the of the indoor furnishings with an eye to indoor air quality and environmental sustainability.

It would be pointless to put so much attention into a house like this if the house were not also a joy to be in and to live in, so I give deepest gratitude to my designer and business partner, Beth Williams, who designed this wonderful small home.

The home sits lightly on the planet. Its real success is shown in the faces of the people who walk through the house, as well as in the faces of the Bryants since they've moved in. It's a joyful space to come home to. Vicky talks about how filling her tub up with solar-heated water feels like "bathing in sunshine." That's a luxury a person can feel good about.

— *Michael Chandler, president of Chandler Design-Build and a GBA Advisor, has been designing and building high-performance homes since 1978.*

General Specs and Team

Location:	Saxapahaw, NC
Bedrooms:	3
Bathrooms:	2
Living Space:	2498
Cost:	158

Builder: Chandler Design-Build **Designer:** Beth Williams, Chandler Design-Build **Energy consultants:** Southern Energy Management

Construction

Foundation: Slab on grade, 9-in. PolySteel ICF perimeter insulation, 2 layers 1-in. XPS foam under slab

Walls: 13 1/2-in. double-stud wall with 1 1/2-in. Spider fiberglass (R-46)

Windows: Peachtree 700 with double-pane, low-e, argon-filled glazing (SHGC = 0.30, U-0.30); windows on south and west have exterior shading

Roof: trusses with 5 1/2-in. top chord.

Roof insulation 8 in. Icynene open-cell foam (R-30)

Garage: detached with breezeway connector

Energy

- Windows laid out for optimal daylighting
- CFL lighting fixtures
- Energy Star appliances
- Chimney effect of stairwell and window layout provides natural cooling, ventilation

- Web-enabled thermostats
- Smoke alarms with long-term battery solution

Energy Specs

Cooling / dehumidification: 15 SEER zoned-bypass heat pump (Heil with R-410A refrigerant).

Water heating: Solar hot water (drain-back system) with 3 solar collectors (Solar Hot USA) and 160-gal. SSTS water tank with internal heat exchanger; backup heater is 120 KBTU/h condensing natural gas on-demand water heater (Quietside ODW-120) with 15-gallon tempering tank.

Annual energy use: being monitored by [Truveon Inc.](#)

Water Efficiency

- Two rainwater catchment systems collect 100% of gutter output for rain gardens and vegetable garden. Water delivered to retaining-wall planter and ornamental garden by capillary action without pumps
- 1.28 gpf toilets
- Low-flow faucets and shower heads
- Xeriscaping with native plants; no lawn
- Energy Star washing machine and dishwasher

Indoor Air Quality

- Exhaust-only ventilation system; Watt Stopper motion sensors in bathrooms respond to building occupancy levels
- 6-in. passive intake damper behind dryer opens in response to modest CFM range hood.
- Zoned-bypass HVAC for enhanced summer dehumidification with cooling
- MERV 11 central air filter
- Airtight wood stove
- Interior paints and sealers contain no or low VOCs
- Formaldehyde-free cabinetry
- No carpet; wide plank local oak flooring upstairs and tile on radiant slab downstairs

Green Materials and Resource Efficiency

- Panelized and truss construction; wall panels built off site with all waste diverted to I-joist plant
- Trussed roof and floor to minimize waste on site

- Extra deep roof overhangs (32" plus 6" half-round gutters) shade windows and protect siding from rain
- Wrinkle Wrap Tyvek housewrap with two layers of #15 asphalt felt integrated into drip screed and step flashings with kick-outs
- SpiderLath gasketed non-metallic stucco lath seals nail penetrations and anchors stucco to building; air space behind provided by the wrinkling of the felt when wetted by the stucco application, diverting water down the gaskets to the weep screed and out
- Clad widows trimmed by fiber-cement board exterior trim before stucco

Site Design##

- Sited on an abandoned septic field for old mobile home park
- No lawn, trees protected under supervision of an arborist during construction

Certification

- Energy Value Housing Award finalist
- LEED-H certified Silver
- NAHB-green ANSI 900 certified Gold
- Local Green Home Builders of the Triangle certified Gold
- Energy Star certified HERS 48
- US DOE Builders Challenge certified
- Ongoing third-party energy monitoring by [Truveon Inc.](#)