

# Mixed, Humid Climate Region 40+% Energy Savings



## Broad Run Farms

### Sterling, VA

Developer/Owner:	Paragon Homes
Location:	Sterling, Virginia
Building Type:	Single Family Detached
Building Size:	3,500 - 5,500 sq ft
	3-5 bedrooms, 3.5-5 baths
Price:	from the mid \$700s
Status:	5 Completed, Additional Lots Available
SWA Contact:	Srikanth Puttagunta

Paragon Homes has been building homes in Northern Virginia since 1977. This husband and wife duo continues to push the market in terms of energy efficiency and home design. With the current popularity of going “green”, it is interesting that Paragon chooses to focus only on reducing the energy footprint of their homes, improving the overall comfort of the home, and maintaining the durability of the overall product. Their belief is that “energy saving building practices ultimately save you money and the planet we all share.”



The majority of the homes for this initial community scale project were part of the Broad Run Farms development. Work moved on to the Potomac Farms development, where an additional home was built. Paragon Homes has 22 potential lots in the Potomac Farms community and 3 additional lots in the Broad Run Farms community for future development when the market picks back up. Paragon Homes has made the commitment to achieve the same level of performance on these future homes as were achieved in this initial community scale project.

***“We are committed to quality by using the best materials and building methods available. The ‘Builder Grade’ is not our level of quality.”***

The homes have been designed to perform 40+% better than the Building America benchmark house (comparable to mid-1990s construction). To achieve the desired reduction in energy use, SWA recommended 2x6 optimum value engineered framing with added insulation; insulated sheathing; headers moved up into the floor system; low-emissivity windows with a Solar Heat Gain Coefficient (SHGC) of 0.32; tightly sealed envelope achieving an annual natural infiltration rate of 0.12 ACH; SEER-13/7.7 HSPF heat pumps; tankless hot water heaters with an efficiency rating of 0.84; mastic sealing and buried ducts in the attic to achieve <2.3 cfm<sub>25</sub>/100 ft<sup>2</sup>; and ENERGY STAR fixtures and appliances.

#### ENERGY EFFICIENT FEATURES

- Takagi TK1 tankless water heater (0.84 EF)
- Jeld-wen Vinyl & Wood IG low-e windows (U-0.35, SHGC-0.32)
- Blown-in cellulose insulation (R-40) in attic
- Blown-in cellulose insulation (R-21) in walls + 1” Dow Styrofoam rigid insulated sheathing (R-5)
- 1/2” Dow Styrofoam (R-3) on interior foundation wall with encapsulated FGB (R-13) in studded out walls
- Spray-foam insulated rim/band joists
- Lennox 13HPD SEER 13/7.7 HSPF heat pumps
- Energy Star® Kenmore Elite Appliances
- ASHRAE 62.2 compliant exhaust-only ventilation
- Mastic-sealed ductwork

#### CERTIFICATIONS

Exceeds Energy Star® Homes Standards with HERS Index ≤ 66

<http://www.paragonhomes.org>



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# Cost - Neutrality/Marketing

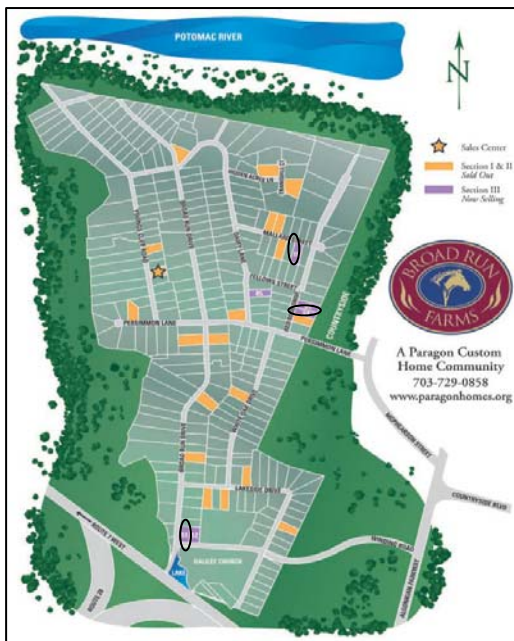


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The long-term goal of the Building America program is to develop cost-effective systems for homes that can produce as much energy as they use—a zero energy home. As teams increase the savings targets towards zero energy homes, maintaining cost neutrality is a key component. The added cost of higher efficiency technologies can typically be offset by reducing unnecessary waste in other systems or through utility bill savings. The annual mortgage payment is calculated based on a 30 year mortgage with a 7% fixed interest rate. For Paragon's average home model, the cost neutrality is positive, so their homes are cost-effective in the long-run for homeowners.

Measure	Avg. Incremental Cost
Adding 1/2" rigid insulation on interior of foundation walls	\$1,800
Spray foaming rim/band	\$800
Upgrading to low-e windows	\$600
Upgrading from R-30 to R-40 attic insulation	\$400
Tight ductwork (mastic sealed)	\$2,000
Upgrading to a tankless water from standard gas water heater	\$1,500
CFL lighting	\$500
Going from 2x4 studs @ 16" on center to 2x6 @ 24" o.c.	\$1,000
Increasing from R-13 to R-21 wall insulation	\$1,000
Putting 1" rigid sheathing on exterior of above-grade walls	\$2,000
Upgrade to Energy Star Appliances	\$570
<b>added first cost</b>	<b>\$12,170</b>
<b>annual mortgage payment</b>	<b>(\$1,079)</b>
<b>annual utility savings</b>	<b>\$1,287</b>
<b>neutral cash flow</b>	<b>\$208</b>



Unit Type	HERS Index	Annual Estimated Home Utility	Est. Savings Compared to Code Compliant Home	
			[\$]	[%]
House 1	66	\$1,814	\$424	18.9%
House 2	59	\$2,437	\$591	19.5%
House 3	66	\$1,962	\$479	19.6%
House 4	66	\$2,105	\$435	17.1%
House 5	64	\$2,180	\$457	17.3%

In early July 2008, Paragon Homes was able to sell two homes in the same week. Given the status of the current market and the size of this builder, it speaks towards the marketability of what they are trying to do in terms of energy efficiency. The buyers were a doctor and two engineers. Even during site visits, CARB was approached by these homeowners asking specific questions about the performance of these homes, so it was a clear selling point for these buyers.

The table to the left shows the estimated annual utility savings of Paragon Homes compared to comparable homes built to minimum code standards (2003 IECC). A savings of 18.5% or nearly \$500 on a homeowner's utility bills is a significant savings with today's energy costs.



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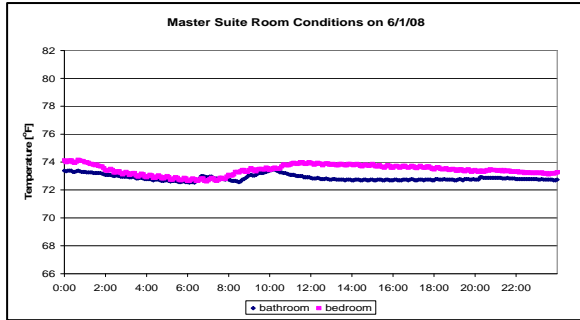
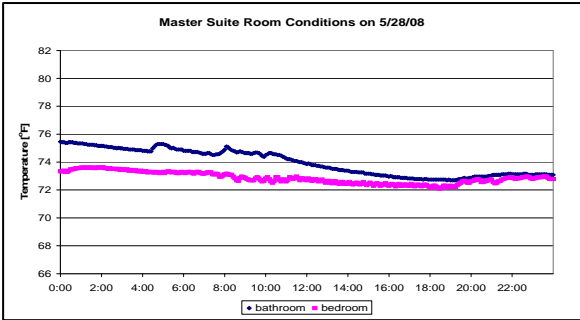
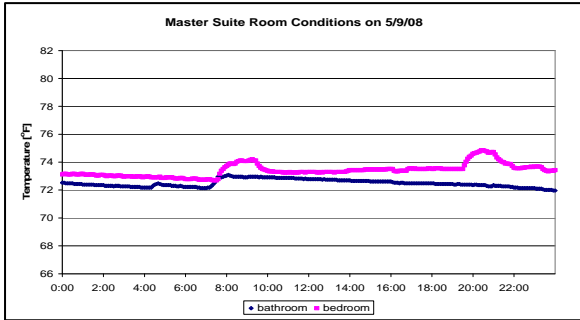
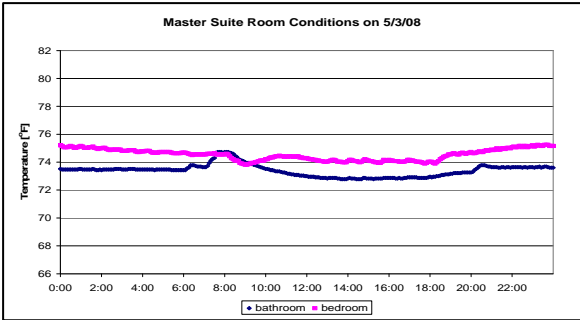
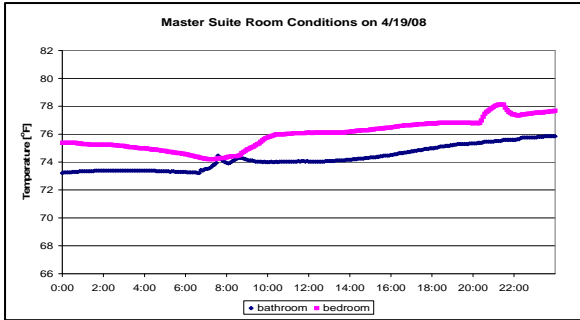
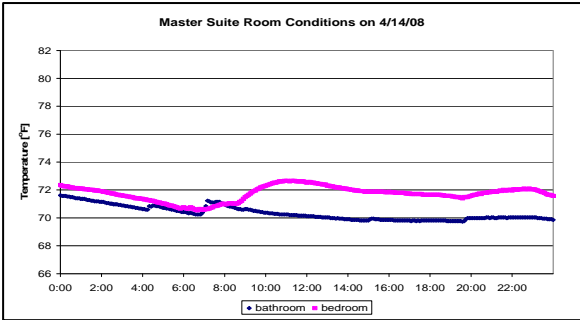
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SWA was informed that there was a concern about insufficient heating and/or cooling of the Master Bathroom at the 2<sup>nd</sup> residence built in Sterling, VA. This bathroom adjoins the Master Bedroom which contains the non-programmable thermostat for the upstairs forced-air unit. The temperature differential between these rooms was investigated by placing a HOBO temperature/relative humidity data logger in the Master Bedroom and Master Bath. These were both placed at comparable heights in their respective rooms.

The data from the nearly two months of cooling data show that temperature levels are within permitted limits. According to the Air Conditioning Contractors of America's (ACCA) Manual RS, a 3°F temperature difference between any two rooms in a home is accept-

able for maintaining reasonable comfort during the cooling season, with 6°F temperature differential being the maximum allowable. For heating, this range drops down to a 2°F average difference with a 4°F maximum.

The temperature range between the two rooms during the cooling season doesn't exceed 3°F over the monitoring period as can be seen in the following charts. The master bath was consistently cooler than the master bedroom. It was recommended to the builder to move the location of the thermostat so that it is not directly in the flow path of the supply register in the master bedroom. This could be causing the system to short cycle prior to fully conditioning the entire zone.





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To get more insight from the builder, CARB interviewed Rosalyn Simpson, co-owner of Paragon Homes.

What are the most important services that Building America and CARB was/is able to provide Paragon Homes?

I can not say enough about the technical services that the program provides us. Without the engineering, we would only guess what is working and what is failing. That for us has made the difference in being able to move forward to new levels. We can quickly get to the practices that are working and proceed to the next complex idea that we would like to incorporate into practice.

Do you see Paragon Homes continuing to implement the techniques and strategies that were pursued in this project in future communities?

Our goal is to build a Zero Energy Home. We will continue to pursue this goal. It is realistic and attainable. As a company, we learn new techniques and incorporate new materials on each home we build. This is a necessary progression as a builder of new homes of the future.

How difficult has it been to get sub-contractors (HVAC, plumbing, electrical, framing, etc.) to get on board with what Paragon Homes is trying to do with Building America? Has the down-shift in the market made it easier?

We believe that had we not of had the slowdown in the market, our Subs would not have participated in our goal of better built homes. It is very difficult for the trades to do their work in different ways. When work became scarce, the Subs tried to make us, the Builder, satisfied.

How has this housing market downturn affected Paragon Homes?

The downturn has helped our sales. The customer has become focused on value and quality, rather than marketing looks and golf courses. Pricing and quality are now key issues in the new homes purchase environment. However, the market is going to face very difficult challenges with existing homes selling at substantial discounts. A new home will have to be far superior to an existing home on super sale for a buyer to justify the price differential from existing to new.

Have you seen any signs of the market improving in 2009?

There are only signs of the market getting worse. The banks have tightened credit to levels that are worse than normal conditions. Confidence is low for all investments. We see the market having several more years of hard times.

What is your take on the current housing market and the future of certification programs such as EPA's Energy Star?

Any program that assures the customer they are getting something better than they live in now and solve their problems I believe will only be a good thing. The customer needs clarity in this new field of energy reduction and to have rating systems that are universal for all building/products is necessary for the consumer.

Are potential buyers specifically requesting energy efficiency or what is really on their mind for a new home?

I cannot say they are requesting any energy efficiency items. However when the question is given to them "Would you like a more energy efficient home?" they are very interested. This is an idea that is going to be an education for the consumer. Builders are going to have to demonstrate the idea and make the energy hype into something believable to the customer.

Have you been able to cost-effectively incorporate these energy-efficiency measures into your standard practice specifications? This has been challenging to keep costs under control.

Right now we have been able to keep costs at sustainable levels.

What is the value that you, as the builder, see in selling an energy efficient home?

It becomes a personal issue. Personally there is much value to knowing that you can do a better job and that you choose to give this to your buyer. Sometimes the customer appreciates the extra effort to give them an energy efficient home. But all the time they expect to have the most energy efficient home that can be built. They just don't realize how much work it is to get that product.