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Practices and Processes of Leading High Performance Home Builders in the Upper Midwest

E. VonThoma and C. Ojczyk
NorthernSTAR Building America Partnership

December 2012

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Practices and Processes of Leading High Performance Home Builders in the Upper Midwest

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Definitions

ACH	Air changes per hour
AFUE	Annual fuel utilization efficiency
BA	Building America
BEopt	Building Energy Optimization
Btu	British thermal unit
CFL	Compact fluorescent lighting
DOE	U.S. Department of Energy
ERV	Energy recovery ventilator
ft^2	Square foot
HERS	Home Energy Rating System
HRV	Heat recovery ventilator
IECC	International Energy Conservation Code
LEED	Leadership in Energy and Environmental Design
MBtu	Million Btu
o.c.	On center
OSB	Oriented strand board
RESNET	Residential Energy Services Network
ROI	Return on investment
SEER	Seasonal energy efficiency ratio
SHGC	Solar heat gain coefficient
UA	Sum of U-factor times assembly area
yr	Year

Executive Summary

The U.S. Department of Energy Building America Program is a research and development program to improve the energy performance of new and existing homes in all U.S. climate zones while increasing comfort, safety, and durability. Although Building America offers a comprehensive library of information on improving energy efficiency in new and existing homes, only a small number of builders promote and build high performance homes (30% better than code). There is a gap between the availability of information to create high performance homes and the use of that information by the building industry. The reasons for the gap and for why builders are not promoting or applying the available information are unknown. The Northern*STAR* Building America Partnership team proposed this study to gain insight into the business, sales, and construction processes of successful high performance builders. The knowledge gained by understanding the high performance strategies used by individual builders, as well as the process each followed to move from traditional builder to high performance builder, will be beneficial in proposing more in-depth research. That research, in turn, will yield specific action items to assist the industry in transforming to high performance new home construction.

This investigation identified the best practices of three successful high performance, custom home builders in the upper Midwest: Amaris Custom Homes, Christian Builders, and Cobblestone Homes. In-depth field analysis of the performance levels of their homes, their business models, and their strategies for market acceptance was conducted. All three builders commonly seek ENERGY STAR certification for their homes and implement strategies that would allow them to meet the requirements for the Building America Builders Challenge certification program. Their desire for continuous improvement, willingness to seek outside assistance, and ambition to be leaders in their field are common themes. Overcoming challenges in building high performance homes was accepted as part of doing business. It was concluded that crossing the gap from code-based building to high performance based building was a natural business evolution for these leading builders.

Each of the builders continues to experience market and field staff challenges when promoting and building high performance homes. The primary challenge cited was a lack of education among trade contractors, particularly HVAC contractors, about energy efficient construction. Collectively, the builders believe that imminent energy code changes are necessary for moving the industry forward. They feel that the majority of builders and contractors will not implement energy efficient measures if they are not required to engage in the process. The builders also commented that the variety of high performance building certification programs (i.e., Builders Challenge, ENERGY STAR for Homes, Leadership in Energy and Environmental Design for Homes, and National Green Building Standard, among others) was adding to confusion in the marketplace. All three builders would welcome more competition that would raise consumer awareness and demand for high performance building.

1 Introduction to the Problem

1.1 Background

Years of research on energy efficiency for residential homes has created an abundance of technical information to inform professionals in the building industry about how to achieve significant energy savings in new construction. The U.S. Department of Energy (DOE) has been leading the way in creating usable, measurable energy improvement strategies for all climates. The DOE Building America (BA) Program sponsors research and development designed to improve the energy performance of new and existing homes. The ultimate goal of the BA program is to achieve cost-effective, energy efficient solutions for all U.S. climate zones.

One pathway to energy savings and better buildings is through the BA Builders Challenge program. Under this program, builders are certified for energy efficiency and high performance homes strategies by meeting minimum requirements for energy performance, mechanical ventilation, occupant ventilation, combustion safety, and building envelope moisture control. The program uses the Builders Challenge Best Practice Guides and Technology Information Packages as the basis for certification (as an example, see DOE [2008]).

Central to the Builders Challenge is third-party verification of the design and installation process to reduce construction risk and increase the opportunities for the home to perform as planned. A home must reach a Home Energy Rating Score (HERS) of 70 or less and undergo third-party field review. The scoring and the field review must be conducted by an independent home energy rater qualified through the Residential Energy Services Network (RESNET) or an approved third-party verifier.

Similarly, the EPA has its own off the shelf technology package for whole-house energy efficiency through its ENERGY STAR for Homes Program. A professional that builds a home to ENERGY STAR version 2 standards will, on average, create a home that is 20% to 30% more energy efficient than a code-based home. Again, a HERS rating and a third-party field review are required, both conducted by an independent home energy rater qualified through RESNET.

April of 2012 ushered in a new partnership between BA and ENERGY STAR when BA aligned the Builders Challenge with the new ENERGY STAR for Homes version 3. This partnership introduced stricter standards for energy and air quality, as well as strategies for reduced water use and pollutant source control. The new program—named DOE Challenge House— positions the home builder to construct a home with a HERS of 60 or less or a minimum 40% energy savings as compared to the 2004 international residential code.

Builders Challenge and ENERGY STAR have cultivated industry partners from the manufacturing sector to develop and deploy products and systems that will help builders meet energy efficiency and high performance home goals. Many of the products and service providers can be found on the websites of the two programs, assisting builders in moving easily from information to action. The partners in DOE Challenge House can be found at www4.eere.energy.gov/buildings/challenge/locator/. ENERGY STAR partners are listed at www.energystar.gov/index.cfm?fuseaction=estar_partner_list.showpartnersearch.

The challenge with bringing the residential construction industry, as a whole, into high performance building begins with a lack of understanding of what motivates industry professionals to adopt new building and business strategies. An understanding of the obstacles that prevent professionals from adopting strategies that would improve their product and customer experience is also needed.

Although the Builders Challenge website lists "unaware of resources" as one of the top reasons why builders are not building high performance homes, additional potential challenges to market transformation can include the following:

- Time, money, and expertise to train contractors/staff might be in short supply.
- The vast amount of information on high performance building can overwhelm a builder who lacks the education or time to discern what is relevant.
- Lack of understanding of the benefits of high performance homes might impede the ability of a builder or sales staff to sell confidently to homeowners.
- According to the *Myth of the Best Practice* (May 2011), best practices can be counterproductive when they are adopted without the intent to learn.

1.2 Introduction

BA Best Practice Guides and Builders Challenge Technology Information Packages describing how to achieve 30%+ energy savings at a net neutral cost to the homebuyer are readily available. The question remains, then: Why do some builders adopt high performance building strategies but the larger market has not engaged in this level of performance?

The Northern*STAR* Building America Partnership team proposed this comparison study to gain insight into the business, sales, and construction processes of several successful high performance builders. The knowledge gained by understanding the high performance strategies used by individual builders, as well as the process each followed to move from traditional builder to high performance builder, will be beneficial in proposing more in-depth research. Additional research will supplement the results of this study to yield specific action items to assist the industry at large in transforming to high performance new home construction and closing the gap between available information and action.

This study focused on three leading high performance custom home builders in the upper Midwest: Amaris Custom Homes, Christian Builders, and Cobblestone Homes. In-depth interviews were conducted to gain information about each company's history and philosophy, to understand the energy strategies they typically include in their home designs, to outline the key components of their business models, and to learn their general marketing strategies as well as those specific to the promotion of high performance homes. The interviews pointed to the leadership characteristics of each builder as the key influencer that helped move each from code-based construction to high performance builder. A leader's attitude was also important in keeping the company focused on high performance goals even when their trade partners lacked the knowledge or interest in energy efficient construction. Reputation in the community was the main feature they all shared and cited as their principal method of obtaining new clients.

Energy modeling was used to assess predicted energy performance of each builder's energy strategies applied to a prototypical home to determine how each builder's strategies compare to the requirements for 2012 International Energy Conservation Code (IECC), ENERGY STAR version 3, and the BA Builders Challenge. Even though all the builders would be considered high performance by meeting the requirements for ENERGY STAR version 2 and the Builders Challenge Program, only one builder includes enough high performance strategies to comply with the most advanced high performance programs (ENERGY STAR version 3 and IECC 2012). The other two builders are very close to this advanced level, needing just a few upgrades to bring them into compliance.

2 Approach

2.1 Builder Interviews

The three high performance builders that participated in this study were chosen based on their leadership in the industry, willingness to adopt new techniques in their companies, and relationship to NorthernSTAR as industry partners. They typically build market-rate, single-family custom homes with attached garages and full basements with lookout windows.

The NorthernSTAR team conducted extensive interviewing of each builder at their places of business. The interviews were designed in a similar format to gather information on customary building practices, business philosophies; targeted price ranges; contracting, construction, and sales processes; and sales in the past year. Obstacles to and successes with high performance building were also queried.

2.2 Energy Modeling

The Building Energy Optimization (BEopt)/EnergyPlus version 1.1 energy modeling software developed by the National Renewable Energy Laboratory in support of the BA program was used to evaluate the energy performance of customary building practices of each of the three builders. A base home representative of their typical home plans was used in the modeling. The base home was two stories and 2,400 ft^2, with four bedrooms, full basements with lookout windows, and a three-car garage.

An additional modeling program, Building Foundation Energy Transport Simulation (BUFETS) rev. B/EnergyPlus 6.0, was used in conjunction with BEopt to produce "adjusted" outputs. BUFETS includes three-dimensional foundation heat transfer including phase change effects and nonlinear material properties as a function of moisture content and temperature. It also allows above-grade foundation walls, lookout and walkout basement configurations, and nonadiabatic slabs to be modeled. (In a lookout basement, the basement walls extend sufficiently above ground level that some of the basement windows are above ground level.) The combination of programs allows for a better understanding of energy performance of homes in areas where regional differences are not captured by BEopt alone. In the Midwest, full and lookout basements are common housing features with unique thermal characteristics that can be captured best through the BUFETS rev.B/EnergyPlus approach.

The REM/Rate software analysis tool was also used to evaluate energy performance alongside BEopt. REM/Rate is the standard program energy raters used in the field. BEopt is used more often in research. Determining if the results are similar for predicting energy use will be useful to an energy rater seeking research information that discusses energy via the BEopt format.

The modeling will also be used to determine how the customary practices of each builder contribute to meeting the performance requirements for Builders Challenge, ENERGY STAR, and IECC 2012.

3 Results

All three builders typically build market-rate, single-family custom homes with attached garages and full basements with lookout windows. The price points for their homes are similar. Their primary selling points are their reputations for quality and their standing in the community. They all promote energy efficient strategies on their websites. They all sought outside consultants to help transform their construction practices. They all aim to remain competitive while encouraging more builders to enter the high performance market as a means to help drive consumer interest. In contrast to their common interests and success, they have all become successful in the high performance market with different business models, staffing, and processes.

3.1 Builder Interviews

3.1.1 Customary Building Systems

Table 1 displays the details of the customary building systems and performance attributes for each of the participating builders.

Table 1. Customary Building Systems of the Participating Builders

Building System	Amaris Custom Homes	Christian Builders	Cobblestone Homes
Cooling Equipment	SEER = 14	SEER = 13	SEER = 13
Heating Equipment	Gas Furnace AFUE = 95	Gas Furnace AFUE = 95	Gas Furnace AFUE = 92
Duct Leakage	Leakage = 0.5 cfm/100 ft^2 to unconditioned spaces	Leakage = 0.5 cfm/100 ft^2 to unconditioned spaces	Leakage = 0.5 cfm/100 ft^2 to unconditioned spaces
Duct Insulation	R-8	R-8	R-8
Infiltration	0.8 ACH50	1.2 ACH50	1.5 ACH50
Ceiling Insulation	R-60	R-44	R-49
Wall Insulation	R-21	R-21	R-19
Foundation Insulation	R-10 exterior continuous and R-10 interior rigid foam board[a]	R-10 exterior continuous	R-5 exterior continuous rigid foam[b]
Windows	U-Value = 0.24; SHGC = 0.23	U-Value = 0.30; SHGC = 0.19	U-Value = 0.30; SHGC = 0.29
Water Heater	40-gal gas, EF = 0.64	40-gal gas, EF = 0.64	50-gal gas, EF = 0.65
Appliances and Lighting	ENERGY STAR appliances, 80% CFLs	ENERGY STAR appliances, 60% CFLs	ENERGY STAR appliances, 40% CFLs
Mechanical Ventilation	ERV @ 76.8 cfm per ASHRAE 62.2, 72% efficient	ERV @ 76.8 cfm per ASHRAE 62.2, 72% efficient	ERV @ 76.8 cfm per ASHRAE 62.2, 72% efficient
Exterior Walls	2 × 6, 24-in. o.c.	2 × 6, 16-in. o.c.	2 × 6, 16-in. o.c.
Sheathing	R-5.5 rigid foam structural insulated sheathing	R-1.22 ½-in. fiberboard sheathing	OSB w/R-3 rigid foam insulated sheathing[b]
Cladding	Cementitious siding	Vinyl siding	Vinyl siding
Gypsum	5/8 in.	5/8 in.	5/8 in.
Interior Walls	2 × 4	2 × 4	2 × 4
Interzonal Walls	16-in. o.c., ½-in. gypsum, not insulated	16-in. o.c., ½-in. gypsum, not insulated	16-in. o.c., ½-in. gypsum, not insulated

[a]Amaris currently uses a combined interior/exterior foundation insulation system. Before adopting this system, the builder experimented with Thermax on the interior, spray foam on the exterior, and rigid foam on the exterior. Amaris is currently looking at insulated concrete forms.
[b]Before adopting their current wall sheathing system (OSB with R-3 rigid foam insulated sheathing), Cobblestone experimented with OSB sheathing, structural insulating sheathing, and Zip System wall sheathing.
Notes: SEER, seasonal energy efficiency ratio; AFUE, annual fuel utilization efficiency; ACH, air changes per hour; SHGC, solar heat gain coefficient; EF, energy factor; CFL, compact fluorescent lighting; ERV, energy recovery ventilator; o.c., on center; OSB, oriented strand board.

3.1.2 Builder Characteristics

3.1.2.1 Amaris Custom Homes, White Bear Lake, Minnesota

www.minnesotagreenhomebuilder.com

The staff describes the company as a custom green home builder. The typical sales price of their homes is between $275,000 and $350,000. They have been in business since 2003 and have a staff of four— the owner, a construction manager, an interior designer, and an office manager. The owner does sales and performs contracting functions. The company's primary marketing tools are a website and blog. The contract with the clients is on a cost-plus basis with a flat rate construction management fee. All projects are competitively bid with three to four contractors based on detailed specifications. The owner uses a documented questionnaire with each client to address client's interests during the sales process, which is used to educate the client on the process and practices Amaris employs that differ from competitors. The company positions itself as offering the highest quality at the best value. Amaris has built certified ENERGY STAR and Leadership in Energy and Environmental Design (LEED) homes.

3.1.2.2 Christian Builders, Rogers, Minnesota

www.christianbuilders.com

The staff describes the company as a local and national leader in energy efficient custom home building. The typical sales price of their homes is between $275,000 and $350,000. They have been in business since 1974 and have a staff of four: two owners, a construction manager, and an office manager. One owner engages in sales; the other owner performs the contracting function. Christian Builders has been an ENERGY STAR builder since 1998 and was an EnergyValue Housing Award Winner in 1999. The company's primary marketing tools are a website and its reputation. The contract with the clients is on a negotiated lump-sum basis. All projects are competitively bid with three to four contractors. Work requirements are loosely defined based on custom and practice rather than detailed specifications. The sales process does not address energy efficient practices unless the client inquires about energy efficiency. The company positions itself as a premier energy efficient custom homebuilder.

3.1.2.3 Cobblestone Homes, Saginaw, Michigan

http://cobblestone.me

The staff describes the company as an innovative, high performance custom home builder. The typical sales price of their homes is between $300,000 and $400,000. They have been in business since 2002 and have a staff of nine: two owners, four project managers, a warranty manager, a draftsperson, and an office manager. One of the owners engages in sales and performs the contracting functions. Cobblestone Homes has been an ENERGY STAR builder since 2005 and was an EnergyValue Housing Award winner in 2011. The company's primary marketing tools are a website and a Facebook page. Sales contracts with clients are on a negotiated lump-sum basis. Projects are single sourced with key contractors per trade. Work requirements are based on custom and practice built on long-term relationships over time. The sales process is used to develop close relationships with clients and focuses on customer satisfaction that leads to referrals. The company positions itself as leading the market with high performance homes.

Table 2 summarizes the builders' characteristics and key business practices.

Table 2. Builder Characteristics and Key Business Practices

	Amaris Custom Homes	Christian Builders	Cobblestone Homes
Builder Type	Custom Homes	Custom Homes	Custom Homes
Price Point	$275–$350K	$275–$350K	$300–$400K
2011 Sales	5	15	60
Purchasing Process	Competitive bid, well-defined specification	Competitive bid, loose specification based on custom and practice	Single source, no specification, custom and practice
Construction Process	Design-build	Design-build	Design-build
Sales Process	Direct sales by owner	Direct sales by owner	Direct sales by owner
Positioning	Highest quality at best value	Premier energy efficient custom homebuilder	Leading the market with high performance homes
Marketing Process	Website and blog	Website and reputation	Website and Facebook page

3.1.3 Builder Process Strategies

All three companies are custom builders and have custom approaches to general sales, customer education about the design and construction process, and the selling of energy strategies to homeowners. The following paragraphs outline each builder's unique processes.

3.1.3.1 Amaris Custom Homes

Amaris Custom Homes applies a "sales as education" approach working with interested clients in a quality assurance meeting for approximately 2 hours for every project. Eighty percent of the meeting time is spent reviewing the Amaris approach to construction specifications. Amaris also applies an open book approach to costing with its clients. Trade contractor bids are shared with the client, the client is charged a flat construction management fee for the project, and a cost-plus percentage is applied on top of hard costs. The owner has also become a dealer of residential solar power systems, offering these systems as options to their clients at wholesale pricing as a differentiator to competitors.

3.1.3.2 Christian Builders

Christian Builders was an early pioneer in energy efficiency by building demonstration projects with a local municipality. Christian Builders also offers extensive homebuyer education opportunities through videos on its website with topics including comfortable living, health and safety, durability, energy efficiency, and operations and maintenance. The website also features video testimonials from clients. Visitors to the website spend approximately 8 minutes on the site. Considering that the average duration a visitor spends at a website is 56 seconds (Marketing Charts [2012]), Christian Builders has created a way to effectively engage readers.

3.1.3.3 Cobblestone Homes

Cobblestone Homes began its journey with high performance homes under the mentorship of Ideal Homes of Norman, Oklahoma. Ideal Homes has been an industry-leading energy efficient builder for the past 20 years. Cobblestone Homes pays only a 2.5% commission to outside realtors. With outside realtors accounting for approximately one-half of Cobblestone's annual sales, the effective rate is a 1.25% commission. Competitive builders in this market pay a total of 5% commission to realtors. Cobblestone applies this difference in commission rates toward energy efficiency measures as part of their budgeting process. Cobblestone Homes' performance metrics also include goals for obtaining local press coverage. The company accomplishes this by showcasing new technologies and building demonstration homes.

3.1.4 Common Themes Sited by the Three Builders

Results of the builder interviews found that the builders in this report shared commonalities in both philosophy and approach to their businesses. They also experienced similar obstacles when trying to implement energy efficient strategies in their processes.

3.1.4.1 Business Practices

The builders all have experience working with outside experts for both technical and business (marketing and management) improvement. All three builders consult with Building Knowledge Inc. on building science and best building practices as a means to improve their homes. Cobblestone also enlisted the expertise of Ideal Homes as a mentor when the company entered the home building market.

The builders are metric driven and participate in a continuous improvement cycle. They all focus on home performance (typically HERS), profitability, and internal metrics. (Cobblestone Homes lists targeting a specific number of articles in the local newspaper as a yearly strategic goal.)

All the builders experiment with materials and systems to learn what does and does not work with their construction process and metrics. They are all willing to challenge the status quo of the industry to drive consumer interest.

Although all three builders feature energy efficiency prominently in their marketing efforts, they all note that it is a small part of their overall distinction as home builders. Their primary selling point is a reputation of quality and community standing.

3.1.4.2 Obstacles to High Performance

The builders cited trade contractor education about energy efficient construction as a primary challenge. The HVAC contractor was singled out as the most challenging because they have experienced issues related to design calculations, proper sizing, and distribution.

The three builders cite the variety of high performance building certification programs (i.e., Builders Challenge, ENERGY STAR for Homes, LEED for Homes, and the National Green Building Standard, among others) as adding confusion to the marketplace and leading to inaction by other builders.

The builders have stated that energy code changes are necessary for moving the industry forward and that the majority of builders would not implement energy efficient measures if they were not required to do so.

3.2 Energy Modeling

3.2.1 BEopt and Adjusted BEopt Analysis

A prototype base home configuration was developed to represent a typical move-up custom home in the upper Midwest and to reflect the designs offered by the participating builders. Table 3 outlines this typical plan.

Table 3. Prototype Building Configuration and Location

Building Specifications	Details
First-Floor Square Footage	1,320: 30 × 44
Second-Floor Square Footage	1,290: 30 × 43
Basement Square Footage	1,320: 30 × 44
Stories	2
Roof	Gable 6/12 slope
Bedrooms	4
Bath	2½
Attic	Std. attic, vented
Window to Wall Area Above-Grade Wall	.051 (S); .011 (W); .032 (N); .031 (E)
Foundation	Lookout Basement
Garage	Attached; 750 ft^2: 30 × 25
Above-Grade Exposed Foundation Wall Height	10 in.
Climate	Minneapolis

Figure 1 represents the BEopt outcomes when the customary building systems of the three builders, as displayed in Table 1, are input into the prototype building configuration outlined in Table 3. The column labeled BAB represents the B10 Building America Benchmark house built to the 2009 IECC, as well as the federal appliance standards that took effect on January 1, 2010, and lighting characteristics and miscellaneous electric loads most common in 2010. The B10 Benchmark is used as the point of reference for tracking progress toward multiyear energy savings goals established by Building America. The adjusted BEopt outcomes are also displayed to show the energy use when the additional basement characteristics, as noted in Section 2.2, are input into the computation using the BUFETS rev.B/EnergyPlus 6.0.

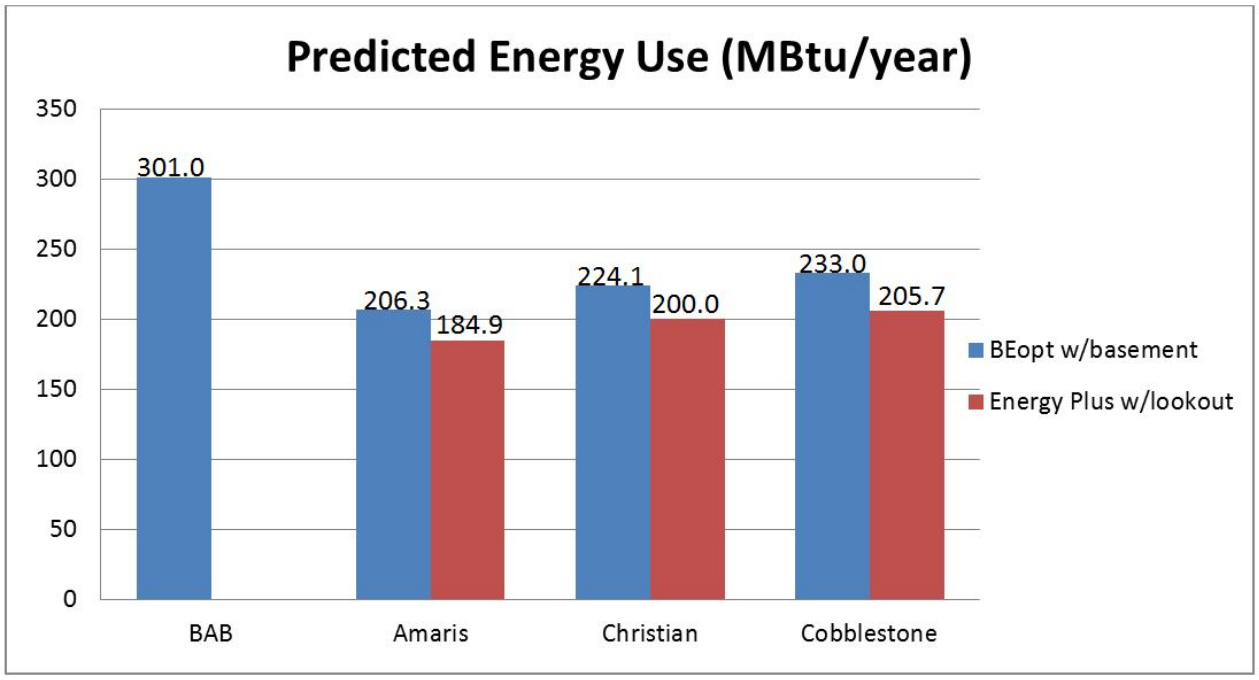

Figure 1. BEopt and EnergyPlus simulation for prototype home

Table 4 summarizes the projected annual energy use of the three builder prototype homes using BEopt with a full basement, BEopt and EnergyPlus with a lookout basement, and REM/Rate. It also includes the adjusted source energy savings of the selected builders' current practices. These savings range from 31.7% to 38.6% over the B10 Benchmark.

Table 4. Annual Energy Use Comparison B10 Benchmark to BEopt and Rem/Rate (MBtu/yr)

Builder	B10 Benchmark Source Energy Use (MBtu/yr)	BEopt Raw Source Energy Use (Mbtu/yr)	BEopt Raw Source Energy Savings Relative to B10 (%)	EnergyPlus Source Energy Use With Lookout Basement (MBtu/yr)	EnergyPlus Simulation Source Savings Relative to B10 (%)	REM/Rate Source Energy Use (MBtu/yr)
Amaris Custom Homes	301.0	206.3	31.5	184.9	38.6	195.8
Christian Builders	301.0	224.1	25.5	200.0	33.6	222.8
Cobblestone Homes	301.0	233.0	22.6	205.7	31.7	234.7

3.2.2 Program Performance Compliance

Table 5 summarizes how the builders' current practices comply with the performance standards of the noted programs. Compliance was determined through the REM/Rate home energy modeling software program. The compliance paths are noted in the individual reports contained in Appendices A, B, and C.

Table 5. Performance Standards Comparison

Performance Standards	Amaris Custom Homes	Christian Builders	Cobblestone Homes
HERS Index	43	49	52
ENERGY STAR v3 Compliance	Yes	No[a]	No[a]
Exceeds IECC 2006 UA Compliance by	30.6%	7.6%	6.5%
Exceeds IECC 2006 Annual Energy Cost Compliance by	62.4%	52.4%	49.5%
Exceeds IECC 2009 UA Compliance by	29.2%	5.7%	4.5%
Exceeds IECC 2009 Annual Energy Cost Compliance by	48.3%	34.8%	33.5%
Exceeds IECC 2012 UA Compliance by	21.8%	No[b]	No[c]
Exceeds IECC 2012 Annual Energy Cost Compliance by	39.0%	23.5%	21.7%
Builders Challenge Compliance	Yes	Yes	Yes

[a] Would meet ENERGY STAR v3 with R-5 exterior insulation or advanced framing
[b] Would meet IECC 2012 UA with R-5 exterior above-grade wall insulation and additional R-5 foundation insulation
[c] Would meet IECC 2012 UA with R-5 exterior above grade wall insulation and additional R-10 foundation insulation

4 Conclusions

All of the participating builders are involved in continuous improvement processes that have led to their success in the high performance building market. Each seeks information, engages metrics, and hires outside consultants as needed.

Table 5 shows that all three builders engage in building practices that exceed the 2006 and 2009 IECC UA Compliance as well as the Builders Challenge. Although Amaris is the only company currently in a position to meet the IECC 2012 UA compliance and ENERGY STAR v.3, the other two builders need to make a only few changes to reach these metrics. This conclusion parallels the information from Table 4 where the simulation models show that all of the participating builders exceed the BA 30%+ energy savings goals over the BA B10 Benchmark with their current standard practices.

Figure 1 and Table 4 demonstrate that the BEopt with EnergyPlus was a more refined method than BEopt for determining source energy savings for homes with lookout basements (a common feature in cold-climate homes). BEopt does not allow lookout basements to be modeled at all, only full basements with the entire wall height located below grade. The energy savings gained from the strategies applied to the lookout wall (entirely above grade in the cases modeled), then, are higher than those obtained by modeling the walls as if they were below grade. The energy savings gained as a result of the strategies employed by the builders would have been missed entirely if not for the BEopt with EnergyPlus with Lookout Basement modeling. Only three samples comprised the test population in this study, but a deeper investigation into the differences between BEopt and BEopt with EnergyPlus might demonstrate that more homes are in line with, or getting closer to, the BA 30%+ energy savings goals, especially in cold-climate regions.

Table 4 also demonstrates that the BEopt and REM/Rate energy analysis programs are fairly equal in predicting source energy savings. This information serves as a beginning point toward understanding how REM/Rate and BEopt language is interchangeable, especially for the builder or energy professional in the field seeking advanced research where results are presented in BEopt language. Because three samples cannot represent conclusive results, further study on the alignment of BEopt and REM/Rate would be useful to advancing an understanding of research results within the industry.

In looking at Table 1, it is interesting to note that each of the builders has been able to employ different building techniques to achieve similar energy performance results. The building techniques being used to achieve high performance represent the evolution of each builder. The reported systems are a combination of strategies each builder has used from the beginning stages of their businesses; strategies with which they experimented and found to be beneficial additions; and those strategies they have added because of the influence of HERS scores, the ENERGY STAR process, and guidance from experts such as building scientists and mentors. Building science is part of each company's equation for high performance, it is not the sole guiding principle for decision making.

No single concern was noted by the builders as a primary barrier to seeking additional industry certifications. Instead, a variety of concerns—cost, market demand, retooling, and/or lack of building science knowledge—seem to be the underlying reasons they do not pursue additional industry recognition. Note, however, that all three builders have similar attitudes in that none sees the various programs or code requirements as their end goal. Instead, the builders are more driven to risk, experimentation, and metrics rather than alignment with the processes required of a particular program.

The participating builders are all custom builders. They view the design/build process and owner-led sales as an opportunity to remain flexible in the delivery of high performance strategies while balancing client needs and retaining a competitive price point. Energy efficiency is a point of marketing distinction and is promoted through their websites, social marketing efforts, and demonstration homes. They all strongly believe, however, that reputation for quality and community standing are the predominant values that separate them from the competition. It is also noteworthy that they have achieved parallel success in high performance with vastly different business models. Additionally, all three have maintained or grown their businesses through the downturn in the economy.

Through all of their success, they have had to deal with obstacles in becoming high performance builders. Trade contractors' lack of education on energy efficiency strategies requires diligence in the field as well as in-depth knowledge in specialty areas. The abundance of building certification programs adds to confusion in the marketplace. All three builders are committed to improvement, so overcoming obstacles is accepted as part of doing business. They are not convinced, though, that other builders will follow suit. It was their collective belief that imminent energy code changes are necessary for moving the industry forward, stating that the majority of builders would not implement energy efficient measures if they were not required to engage in the process.

It can be argued that these builders are not leaders in their markets because they are energy efficient builders; they incorporate energy efficient measures because they are leaders. In other words, these builders see themselves as leaders in quality, innovation, and customer service, and employing energy efficient technologies is one of the ways they demonstrate that leadership. They all welcome any efforts to increase competition to help drive market interest in high performance homes.

A future study that investigates the business, sales, and construction processes of a greater number of high performance builders would be important for determining whether the results of this small sample are relevant and able to be duplicated. This study looks only at what three high performance builders are doing now. A future study that gives insight into what high performance builders are planning to do as codes change or competition increases would be helpful in charting a pathway to high performance for code-based builders. A larger study that investigates attitudes of code-based builders and perceived obstacles to adopting high performance strategies would also lend insight into methods for helping these builders to achieve greater energy efficiencies in their homes.

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Appendix A: Amaris Custom Homes REM/Rate

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

ENERGY STAR VERSION 2.5 HOME REPORT

Date:	January 25, 2012	Rating No.:	
Property:		Rating Org.:	Building Knowledge, Inc.
	,	Rater's Name:	Patrick O'Malley
Builder's Name:	Amaris Custom Homes	Rater's ID:	1998-105
Building Name:	BA Amaris	Rating Date:	1/24/12

Normalized, Modified End-Use Loads (MMBtu/year)

	ENERGY STAR	*As Designed*
Heating:	57.6	23.2
Cooling:	15.0	9.3
Water heating:	13.8	12.7
Lighting & Appliances:	37.5	39.4
Total:	123.9	84.5

HERS Index of Reference Design Home	**63**	**43**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**58**	**43**	**HERS Index**
Size Adjustment Factor:	**0.92**		

HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

Mandatory Requirements for All ENERGY STAR Version 2.5 Qualified Homes

- [X] Duct leakage to outside < 6 CFM25 per 100 sq.ft. of conditioned floor area, per duct system.
- [X] Envelope insulation levels meet or exceed ENERGY STAR v3.0 requirements. (Not Required for Version 2.5!)
- [X] Slab on Grade Insulation > R-5 at IECC 2009 Depth, Climate Zones 4 & above. (Not Required for Version 2.5!)
- [X] Envelope insulation achieves RESNET Grade I installation or Grade II w/sheathing. (Not Required for Version 2.5!)
- [X] Windows meet the 2009 IECC Requirements - Table 402.1.1. (Not Required for Version 2.5!)
- [X] Duct insulation meets the EPA minimum requirements of R-6. (Not Required for Version 2.5!)
- [X] Mechanical ventilation rate is within 100-120% of ASHRAE 62.2-2010 values. (Informational only; Not Required)
- [X] ENERGY STAR Checklists verified and complete. (Not Required for Version 2.5!)

This home MEETS OR EXCEEDS the energy efficiency requirements for designation as an EPA ENERGY STAR Version 2.5 Qualified Home.

REM/Rate - Residential Energy Analysis and Rating Software v12.96

ENERGY STAR VERSION 2.5 HOME REPORT

BA Amaris Page 2

Pollution Prevented		Energy Cost Savings ($/year)	
Type of Emissions	*Reduction*	Heating:	$1312
Carbon Dioxide (CO2) - tons/yr	11.4	Cooling:	$159
Sulfur Dioxide (SO2) - lbs/yr	15.4	Water Heating:	$18
Nitrogen Oxides (NOx) - lbs/yr	33.9	Lights & Appliances:	$122
		Total:	$1610

The energy savings and pollution prevented are calculated by comparing the Rated Home to the ENERGY STAR Version 3 Reference Home as defined in the "ENERGY STAR Qualified Homes HERS Index Target Procedure for National Program Requirements, Version 3.0" promulgated by the Environmental Protection Agency (EPA). In accordance with RESNET Mortgage Industry National Home Energy Rating Systems Standards, building inputs affecting setpoints infiltration rates, window shading and the existence of mechanical systems may have been changed prior to calculating loads.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

ENERGY STAR VERSION 2.5 HOME VERIFICATION SUMMARY

Date:	January 25, 2012	Rating No.:	
Property:		Rating Org.:	Building Knowledge, Inc.
		Rater's Name:	Patrick O'Malley
Builder's Name:	Amaris Custom Homes	Rater's ID:	1998-105
Building Name:	BA Amaris	Rating Date:	1/24/12

Building Information

Conditioned Area (sq ft):	3930
Conditioned Volume (cubic ft):	35370
Insulated Shell Area (sq ft):	6618
Number of Bedrooms:	4
Housing Type:	Single-family detached
Foundation Type:	Conditioned basement

Ratings

HERS Index:	43
HERS Index w/o PV:	43
HERS Index Target (SAF Adjusted):	58
HERS Index of Reference Design Home:	63
Size Adjustment Factor:	0.92

Building Shell

Ceiling w/Attic:	R60,T1,BFG15",4-24 U=0.016	Window/Wall Ratio:	0.14
Vaulted Ceiling:	None	Window Type:	U:0.24, SHGC:0.23
Above Grade Walls:	3" SPF, 6-24 +R5.5 U=0.042	Window U-Value:	0.240
Found. Walls (Cond):	R10I,10E R=20.0	Window SHGC:	0.230
Found. Walls (Uncond):	None	Infiltration:	Htg: 0.80 Clg: 0.80 ACH50
Frame Floors:	None	Duct Leakage to Outside:	19.65 CFM @ 25 Pascals
Slab Floors:	Uninsulated U=0.663	Total Duct Leakage:	250.00 CFM @ 25 Pascals

Mechanical Systems

Heating:	Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling:	Air conditioner, 30.0 kBtuh, 14.0 SEER.
Water Heating:	Conventional, Gas, 0.64 EF.
Programmable Thermostat:	Heat=Yes; Cool=Yes
Ventilation System:	Balanced: ERV, 77 cfm, 100.0 watts.

Note: Where feature level varies in home, the dominant value is shown.

This home MEETS OR EXCEEDS the EPA's requirements for an ENERGY STAR Home.
HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

REM/Rate - Residential Energy Analysis and Rating Software v12.96

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2006 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Amaris	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Amaris Custom Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Amaris_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2006 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	21.7
Above-Grade Walls:	157.6	117.2
Windows and Doors:	148.2	97.6
Basement Walls:	50.8	34.6
Overall UA (Design must be equal or lower):	390.9	271.1
Window U-Factor Check (Section 402.6)		
Window U-Factor (Design must be equal or lower):	0.400	0.240

This home MEETS the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2006 edition.) In fact, this home surpasses the requirements by 30.6%.

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R60,T1,BFG15",4-24	0.016	1320.0
Above-Grade Walls			
Wall	3" SPF, 6-24 +R5.5	0.042	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.24, SHGC:0.23	0.240	155.6
Window	U:0.24, SHGC:0.23	0.240	33.6
Window	U:0.24, SHGC:0.23	0.240	97.6
Window	U:0.24, SHGC:0.23	0.240	94.6
Door	R5 steel insul, strm	0.144	21.0

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R10I,10E	0.041	256.0
Wall	R10I,10E	0.036	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2006 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Amaris	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Amaris Custom Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Amaris_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2006 IECC	**As Designed**
Heating:	1463	394
Cooling:	128	86
Water Heating:	210	196
SubTotal - Used to Determine Compliance:	**1801**	**676**
Lights & Appliances:	818	870
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2882**	**1810** *

Window U-Factor Check (Section 402.6)

Window U-Factor (Design must be equal or lower):	0.400	0.240

This home MEETS the annual energy cost requirements and verifications of Section 404 of the 2006 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 62.4%.

Name: Patrick O'Malley Signature:

Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 14.0 SEER.
Water Heating: Conventional, Gas, 0.64 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 0.80 Clg: 0.80 ACH50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set to the "prevailing federal minimum standards" as of January, 2009. These standards are subject to change, and software

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2009 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Amaris	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Amaris Custom Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Amaris_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2009 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	21.7
Above-Grade Walls:	149.7	117.2
Windows and Doors:	148.2	97.6
Basement Walls:	50.8	34.6
Overall UA (Design must be equal or lower):	383.0	271.1
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.240

This home MEETS the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2009 edition.) In fact, this home surpasses the requirements by 29.2%.

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R60,T1,BFG15",4-24	0.016	1320.0
Above-Grade Walls			
Wall	3" SPF, 6-24 +R5.5	0.042	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.24, SHGC:0.23	0.240	155.6
Window	U:0.24, SHGC:0.23	0.240	33.6
Window	U:0.24, SHGC:0.23	0.240	97.6
Window	U:0.24, SHGC:0.23	0.240	94.6

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R10I,10E	0.041	256.0
Wall	R10I,10E	0.036	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2009 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Amaris	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Amaris Custom Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Amaris_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2009 IECC	**As Designed**
Heating:	1145	457
Cooling:	123	104
Water Heating:	195	195
SubTotal - Used to Determine Compliance:	**1463**	**756**
Lights & Appliances:	818	870
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2545**	**1890** *

Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.240
Home Infiltration (Section 402.4.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

This home MEETS the annual energy cost requirements and verifications of Section 405 of the 2009 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 48.3%.

Name: Patrick O'Malley Signature:

Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 14.0 SEER.
Water Heating: Conventional, Gas, 0.64 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 0.80 Clg: 0.80 ACH50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2009 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2012 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Amaris	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Amaris Custom Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Amaris_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2012 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	21.7
Above-Grade Walls:	126.1	117.2
Windows and Doors:	135.5	97.6
Basement Walls:	50.8	34.6
Overall UA (Design must be equal or lower):	346.6	271.1
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.240

This home MEETS the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2012 edition.) In fact, this home surpasses the requirements by 21.8%.

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R60,T1,BFG15",4-24	0.016	1320.0
Above-Grade Walls			
Wall	3" SPF, 6-24 +R5.5	0.042	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.24, SHGC:0.23	0.240	155.6
Window	U:0.24, SHGC:0.23	0.240	33.6
Window	U:0.24, SHGC:0.23	0.240	97.6
Window	U:0.24, SHGC:0.23	0.240	94.6

REM/Rate - Residential Energy Analysis and Rating Software v12.96

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R10I,10E	0.041	256.0
Wall	R10I,10E	0.036	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2012 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Amaris	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Amaris Custom Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Amaris_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2012 IECC	**As Designed**
Heating:	922	456
Cooling:	139	115
Water Heating:	195	195
SubTotal - Used to Determine Compliance:	**1256**	**766**
Lights & Appliances:	818	870
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2338**	**1900** *

Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.240
Home Infiltration (Section 402.4.1.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

This home MEETS the annual energy cost requirements and verifications of Section 405 of the 2012 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 39.0%.

Name: Patrick O'Malley Signature:

Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 14.0 SEER.
Water Heating: Conventional, Gas, 0.64 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 0.80 Clg: 0.80 ACH50

REM/Rate - Residential Energy Analysis and Rating Software v12.96

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2012 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

BUILDING KNOWLEDGE

Home Energy Rating Certificate

5 Stars Plus
Projected Rating

Uniform Energy Rating System — **Energy Efficient**

1 Star	1 Star Plus	2 Stars	2 Stars Plus	3 Stars	3 Stars Plus	4 Stars	4 Stars Plus	5 Stars	5 Stars Plus
500-401	400-301	300-251	250-201	200-151	150-101	100-91	90-86	85-71	70 or Less

HERS Index: 43

General Information

Conditioned Area:	3930 sq. ft.	HouseType:	Single-family detached
Conditioned Volume:	35370 cubic ft.	Foundation:	Conditioned basement
Bedrooms:	4		

Mechanical Systems Features

Heating:	Fuel-fired air distribution, Natural gas, 95.0 AFUE.
Cooling:	Air conditioner, Electric, 14.0 SEER.
Water Heating:	Conventional, Natural gas, 0.64 EF, 40.0 Gal.
Duct Leakage to Outside:	19.65 CFM.
Ventilation System:	Balanced: ERV, 77 cfm, 100.0 watts.
Programmable Thermostat:	Heating: Yes Cooling: Yes

Building Shell Features

Ceiling Flat:	R-60	Exposed Floor:	NA
Vaulted Ceiling:	NA	Window Type:	U:0.24, SHGC:0.23
Above Grade Walls:	R-25	**Infiltration:**	
Foundation Walls:	R-20.0	Rate:	Htg: 0.80 Clg: 0.80 ACH50
Slab:	R-0.0 Edge, R-0.0 Under	Method:	Blower door test

Lights and Appliance Features

Percent Fluorescent Pin-Based:	10.00	Clothes Dryer Fuel:	Natural gas
Percent Fluorescent CFL:	70.00	Range/Oven Fuel:	Natural gas
Refrigerator (kWh/yr):	551.00	Ceiling Fan (cfm/Watt):	0.00
Dishwasher Energy Factor:	0.62		

The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

REM/Rate - Residential Energy Analysis and Rating Software v12.96

Rating Number:
Certified Energy Rater: Patrick O'Malley
Rating Date: 1/24/12
Rating Ordered For: Northern STAR

Estimated Annual Energy Cost
Projected Rating

Use	MMBtu	Cost	Percent
Heating	41.5	$388	22%
Cooling	3.2	$85	5%
Hot Water	21.8	$196	11%
Lights/Appliances	39.4	$870	48%
Photovoltaics	-0.0	$-0	-0%
Service Charges		$264	15%
Total		**$1804**	100%

This home meets or exceeds the minimum criteria for all of the following:

EPA ENERGY STAR Version 2 Home
EPA ENERGY STAR Version 2.5 Home
2006 International Energy Conservation Code
2009 International Energy Conservation Code

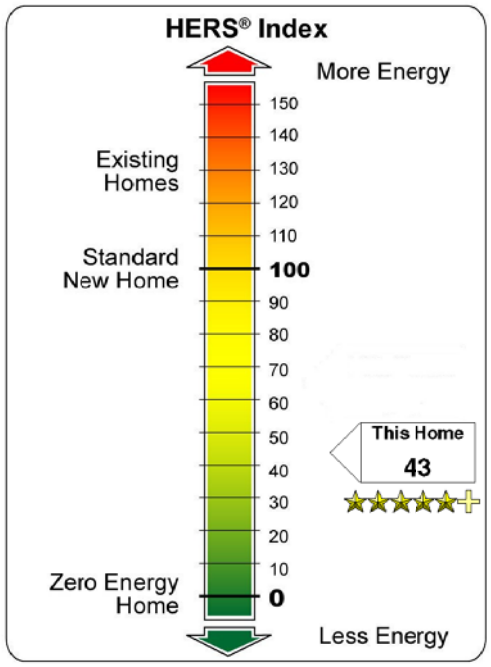
Building Knowledge, Inc.
PO Box 1376
Burnsville, MN 55337
952-944-5605
www.buildingknowledge.com

BUILDING KNOWLEDGE

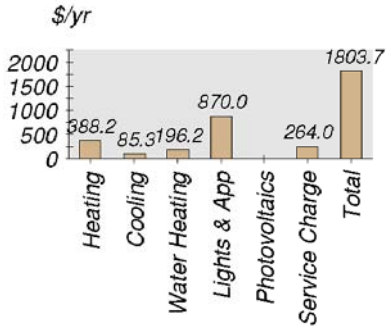
BUILDING KNOWLEDGE PERFORMANCE WITH ENERGY S

ENERGY RATING CERTIFICATE

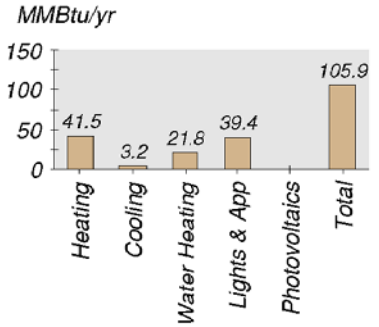
BUILDING KNOWLEDGE



Estimated Annual Energy Cost



Estimated Annual Energy Consumption



Address:

House Type: Single-family detached
Cond. Area: 3930 sq. ft.
Rating No.:
Issue Date: January 25, 2012

Annual Estimates*:
Electric(kWh): 9689
Natural gas(Therms): 728
C02 emissions(Tons): 12
Annual Savings**: $2555

** Based on standard operating conditions*
*** Based on a HERS 130 Index Home*

Building Knowledge, Inc.
PO Box 1376

Certified Rater: Patrick O'Malley
Certification No: 1998-105
Rating Date: 1/24/12

BUILDING KNOWLEDGE

REM/Rate - Residential Energy Analysis and Rating Software v12.96

Builders Challenge
Recognizing Energy Leadership in Homebuilding

EnergySmart Home Scale
QUALIFICATION FORM: PERFORMANCE PATH

Third-Party Verifiers should complete form and submit to:

MAIL: Builders Challenge, 3760 Tanglewood Lane, Davidsonville, MD 21035

EMAIL: builderschallenge@newportpartnersllc.com **FAX:** 301-889-0019

ENERGY PERFORMANCE	
HouseType Single-family detached	**Building Plan Number**
Year built 2012 (Homes completed in 2007 or later may qualify if they meet the energy threshold and a third-party verifier can verify the Quality Criteria)	**Square footage of conditioned space** 3930.0 **Number of Bedrooms** 4
Site address (if not available, list the site Lot#)	**E-Scale Mailing Address (where E-Scale will be mailed)** Attn: Patrick O'Malley PO Box 1376 Burnsville, MN 55337 952-944-5605
Registered Builder Amaris Custom Homes	**Developer (if known)**
Third Party Verifier Building Knowledge, Inc. Patrick O'Malley 952-944-5605 pato@buildingknowledge.com www.buildingknowledge.com	**E-Scale Score/ HERS Index (70-0)** 43 **Date of Rating** 1/24/12 **Identification number** 1998-105 **Rating software (name and version used)** REM/Rate - v12.96 **Estimated annual energy costs($)** 1804 Do you want this on the E-Scale? Yes No **Estimated average monthly energy cost ($)** 150 Do you want this on the E-Scale? Yes No
Estimated annual energy use 9689 kWh (Electric) 728 Therms (Natural Gas)	**Estimated annual energy savings (relative to reference home)** 3843 kWh (Electric) 1402 Therms (Natural Gas)
Energy cost rates 0.09 $/kWh 0.90 $/Therms	**Estimated emissions reductions (relative to reference home)** 11.4 tons of Carbon Dioxide (CO2) 15.4 lbs of Sulfur Dioxide (SO2) 33.9 lbs of Nitrogen Oxides (NOx)

For more information on the Builders Challenge, visit: www.buildingamerica.gov/challenge

Building America U.S. Department of Energy Research Toward Zero Energy Homes

Builders Challenge

Recognizing Energy Leadership in Homebuilding

QUALITY CRITERIA CHECKLIST

☐ As the Third-Party verifier for this house, I certify that the house complies with all the 'Required' Builders Challenge Quality Criteria, as defined by the Builders Challenge Quality Criteria Checklist

ADDITIONAL INFORMATION

House will be certified under these programs (check all that apply):

☐ ENERGY STAR

☐ Environments for Living

☐ LEED for Homes

☐ National Green Building Standard

Appendix B: Christian Builders REM/Rate

ENERGY STAR VERSION 2.5 HOME REPORT

BA Christian Page 2

Pollution Prevented		Energy Cost Savings ($/year)	
Type of Emissions	*Reduction*	Heating:	$1132
Carbon Dioxide (CO2) - tons/yr	9.9	Cooling:	$164
Sulfur Dioxide (SO2) - lbs/yr	13.5	Water Heating:	$18
Nitrogen Oxides (NOx) - lbs/yr	29.4	Lights & Appliances:	$79
		Total:	$1393

The energy savings and pollution prevented are calculated by comparing the Rated Home to the ENERGY STAR Version 3 Reference Home as defined in the "ENERGY STAR Qualified Homes HERS Index Target Procedure for National Program Requirements, Version 3.0" promulgated by the Environmental Protection Agency (EPA). In accordance with RESNET Mortgage Industry National Home Energy Rating Systems Standards, building inputs affecting setpoints infiltration rates, window shading and the existence of mechanical systems may have been changed prior to calculating loads.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

ENERGY STAR VERSION 2.5 HOME VERIFICATION SUMMARY

Date:	January 25, 2012	Rating No.:	
Property:		Rating Org.:	Building Knowledge, Inc.
		Rater's Name:	Patrick O'Malley
Builder's Name:	Christian Builders	Rater's ID:	1998-105
Building Name:	BA Christian	Rating Date:	1/24/12

Building Information

Conditioned Area (sq ft):	3930
Conditioned Volume (cubic ft):	35370
Insulated Shell Area (sq ft):	6618
Number of Bedrooms:	4
Housing Type:	Single-family detached
Foundation Type:	Conditioned basement

Ratings

HERS Index:	49
HERS Index w/o PV:	49
HERS Index Target (SAF Adjusted):	58
HERS Index of Reference Design Home:	63
Size Adjustment Factor:	0.92

Building Shell

Ceiling w/Attic:	R44,T1,BFG15",4-24 U=0.022	Window/Wall Ratio:	0.14
Vaulted Ceiling:	None	Window Type:	U:0.30, SHGC:0.19
Above Grade Walls:	R21,FG1,6-16 U=0.058	Window U-Value:	0.300
Found. Walls (Cond):	R10E R=10.0	Window SHGC:	0.190
Found. Walls (Uncond):	None	Infiltration:	Htg: 1.20 Clg: 1.20 ACH50
Frame Floors:	None	Duct Leakage to Outside:	19.65 CFM @ 25 Pascals
Slab Floors:	Uninsulated U=0.663	Total Duct Leakage:	250.00 CFM @ 25 Pascals

Mechanical Systems

Heating:	Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling:	Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating:	Conventional, Gas, 0.64 EF.
Programmable Thermostat:	Heat=Yes; Cool=Yes
Ventilation System:	Balanced: ERV, 77 cfm, 100.0 watts.

Note: Where feature level varies in home, the dominant value is shown.

This home MEETS OR EXCEEDS the EPA's requirements for an ENERGY STAR Home.
HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2006 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Christian	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Christian Builders		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Christian_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2006 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	28.7
Above-Grade Walls:	157.6	155.4
Windows and Doors:	148.2	120.5
Basement Walls:	50.8	56.5
Overall UA (Design must be equal or lower):	390.9	361.1
Window U-Factor Check (Section 402.6)		
Window U-Factor (Design must be equal or lower):	0.400	0.300

This home MEETS the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2006 edition.) In fact, this home surpasses the requirements by 7.6%.

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R44,T1,BFG15",4-24	0.022	1320.0
Above-Grade Walls			
Wall	R21,FG1,6-16	0.058	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.30, SHGC:0.19	0.300	155.6
Window	U:0.30, SHGC:0.19	0.300	33.6
Window	U:0.30, SHGC:0.19	0.300	97.6
Window	U:0.30, SHGC:0.19	0.300	94.6
Door	R5 steel insul, strm	0.144	21.0

REM/Rate - Residential Energy Analysis and Rating Software v12.96

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R10E	0.070	256.0
Wall	R10E	0.057	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2006 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Christian	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Christian Builders		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Christian_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2006 IECC	**As Designed**
Heating:	1453	577
Cooling:	131	81
Water Heating:	210	196
SubTotal - Used to Determine Compliance:	**1795**	**854**
Lights & Appliances:	860	913
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2919**	**2031** *

Window U-Factor Check (Section 402.6)

Window U-Factor (Design must be equal or lower):	0.400	0.300

This home MEETS the annual energy cost requirements and verifications of Section 404 of the 2006 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 52.4%.

Name: Patrick O'Malley — Signature: _____

Organization: Building Knowledge, Inc. — Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating: Conventional, Gas, 0.64 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 1.20 Clg: 1.20 ACH50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set to the "prevailing federal minimum standards" as of January, 2009. These standards are subject to change, and software

updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2009 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Christian	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Christian Builders		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Christian_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2009 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	28.7
Above-Grade Walls:	149.7	155.4
Windows and Doors:	148.2	120.5
Basement Walls:	50.8	56.5
Overall UA (Design must be equal or lower):	383.0	361.1
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300

This home MEETS the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2009 edition.) In fact, this home surpasses the requirements by 5.7%.

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R44,T1,BFG15",4-24	0.022	1320.0
Above-Grade Walls			
Wall	R21,FG1,6-16	0.058	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.30, SHGC:0.19	0.300	155.6
Window	U:0.30, SHGC:0.19	0.300	33.6
Window	U:0.30, SHGC:0.19	0.300	97.6
Window	U:0.30, SHGC:0.19	0.300	94.6

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R10E	0.070	256.0
Wall	R10E	0.057	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2009 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Christian	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Christian Builders		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Christian_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2009 IECC	**As Designed**
Heating:	1138	660
Cooling:	134	102
Water Heating:	195	195
SubTotal - Used to Determine Compliance:	**1467**	**957**
Lights & Appliances:	860	913
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2592**	**2134** *

Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300
Home Infiltration (Section 402.4.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

This home MEETS the annual energy cost requirements and verifications of Section 405 of the 2009 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 34.8%.

Name: Patrick O'Malley Signature:

Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating: Conventional, Gas, 0.64 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 1.20 Clg: 1.20 ACH50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2009 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2012 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Christian	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Christian Builders		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Christian_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2012 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	28.7
Above-Grade Walls:	126.1	155.4
Windows and Doors:	135.5	120.5
Basement Walls:	50.8	56.5
Overall UA (Design must be equal or lower):	346.6	361.1
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300

This home DOES NOT MEET the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2012 edition.)

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R44,T1,BFG15",4-24	0.022	1320.0
Above-Grade Walls			
Wall	R21,FG1,6-16	0.058	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.30, SHGC:0.19	0.300	155.6
Window	U:0.30, SHGC:0.19	0.300	33.6
Window	U:0.30, SHGC:0.19	0.300	97.6
Window	U:0.30, SHGC:0.19	0.300	94.6
Door	R5 steel insul, strm	0.144	21.0

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R10E	0.070	256.0
Wall	R10E	0.057	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2012 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Christian	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Christian Builders		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Christian_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2012 IECC	**As Designed**
Heating:	915	658
Cooling:	151	112
Water Heating:	195	195
SubTotal - Used to Determine Compliance:	**1262**	**966**
Lights & Appliances:	860	913
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2386**	**2142** *

Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300
Home Infiltration (Section 402.4.1.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

This home MEETS the annual energy cost requirements and verifications of Section 405 of the 2012 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 23.5%.

Name: Patrick O'Malley Signature:

Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 95.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating: Conventional, Gas, 0.64 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 1.20 Clg: 1.20 ACH50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2012 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

BUILDING KNOWLEDGE

Home Energy Rating Certificate

5 Stars Plus
Projected Rating

Uniform Energy Rating System						Energy Efficient			
1 Star	1 Star Plus	2 Stars	2 Stars Plus	3 Stars	3 Stars Plus	4 Stars	4 Stars Plus	5 Stars	5 Stars Plus
500-401	400-301	300-251	250-201	200-151	150-101	100-91	90-86	85-71	70 or Less

HERS Index: 49

General Information

Conditioned Area:	3930 sq. ft.	HouseType:	Single-family detached
Conditioned Volume:	35370 cubic ft.	Foundation:	Conditioned basement
Bedrooms:	4		

Mechanical Systems Features

Heating:	Fuel-fired air distribution, Natural gas, 95.0 AFUE.
Cooling:	Air conditioner, Electric, 13.0 SEER.
Water Heating:	Conventional, Natural gas, 0.64 EF, 40.0 Gal.
Duct Leakage to Outside:	19.65 CFM.
Ventilation System:	Balanced: ERV, 77 cfm, 100.0 watts.
Programmable Thermostat:	Heating: Yes Cooling: Yes

Building Shell Features

Ceiling Flat:	R-45	Exposed Floor:	NA
Vaulted Ceiling:	NA	Window Type:	U:0.30, SHGC:0.19
Above Grade Walls:	R-21	**Infiltration:**	
Foundation Walls:	R-10.0	Rate:	Htg: 1.20 Clg: 1.20 ACH50
Slab:	R-0.0 Edge, R-0.0 Under	Method:	Blower door test

Lights and Appliance Features

Percent Fluorescent Pin-Based:	10.00	Clothes Dryer Fuel:	Natural gas
Percent Fluorescent CFL:	50.00	Range/Oven Fuel:	Natural gas
Refrigerator (kWh/yr):	551.00	Ceiling Fan (cfm/Watt):	0.00
Dishwasher Energy Factor:	0.62		

The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

REM/Rate - Residential Energy Analysis and Rating Software v12.96

Rating Number:
Certified Energy Rater: Patrick O'Malley
Rating Date: 1/24/12
Rating Ordered For: Northern STAR

Estimated Annual Energy Cost
Projected Rating

Use	MMBtu	Cost	Percent
Heating	61.0	$568	28%
Cooling	3.0	$80	4%
Hot Water	21.8	$196	10%
Lights/Appliances	41.0	$913	45%
Photovoltaics	-0.0	$-0	-0%
Service Charges		$264	13%
Total		**$2021**	**100%**

This home meets or exceeds the minimum criteria for all of the following:

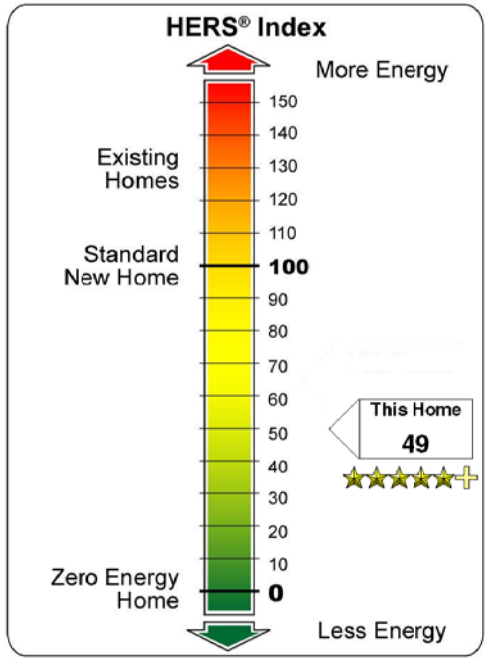
EPA ENERGY STAR Version 2 Home
EPA ENERGY STAR Version 2.5 Home
2006 International Energy Conservation Code
2009 International Energy Conservation Code

Building Knowledge, Inc.
PO Box 1376
Burnsville, MN 55337
952-944-5605
www.buildingknowledge.com

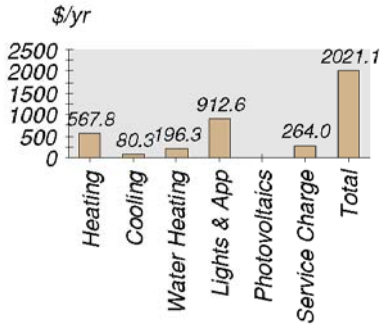
BUILDING KNOWLEDGE

PERFORMANCE WITH ENERGY S

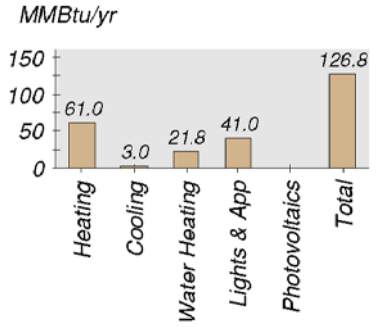
ENERGY RATING CERTIFICATE



Estimated Annual Energy Cost



Estimated Annual Energy Consumption



Address:

,

House Type Single-family detached
Cond. Area: 3930 sq. ft.
Rating No.:
Issue Date: January 25, 2012

Annual Estimates*:
Electric(kWh): 10179
Natural gas(Therms): 920
C02 emissions(Tons): 13
Annual Savings**: $2338

** Based on standard operating conditions*
*** Based on a HERS 130 Index Home*

Building Knowledge, Inc.
PO Box 1376

Certified Rater: Patrick O'Malley
Certification No: 1998-105
Rating Date: 1/24/12

REM/Rate - Residential Energy Analysis and Rating Software v12.96
This information does not constitute any warranty of energy cost or savings. © 1985-2011 Architectural Energy Corporation, Boulder, Colorado
The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building America U.S. Department of Energy Research Toward Zero Energy Homes | Builders Challenge

Recognizing Energy Leadership in Homebuilding

EnergySmart Home Scale

QUALIFICATION FORM: PERFORMANCE PATH

Third-Party Verifiers should complete form and submit to:

MAIL: Builders Challenge, 3760 Tanglewood Lane, Davidsonville, MD 21035

EMAIL: builderschallenge@newportpartnersllc.com **FAX:** 301-889-0019

ENERGY PERFORMANCE	
HouseType Single-family detached	**Building Plan Number**
Year built 2012 (Homes completed in 2007 or later may qualify if they meet the energy threshold and a third-party verifier can verify the Quality Criteria)	**Square footage of conditioned space** 3930.0 **Number of Bedrooms** 4
Site address (if not available, list the site Lot#)	**E-Scale Mailing Address (where E-Scale will be mailed)** Attn: Patrick O'Malley PO Box 1376 Burnsville, MN 55337 952-944-5605
Registered Builder Christian Builders	**Developer (if known)**
Third Party Verifier Building Knowledge, Inc. Patrick O'Malley 952-944-5605 pato@buildingknowledge.com www.buildingknowledge.com	**E-Scale Score/ HERS Index (70-0)** 49 **Date of Rating** 1/24/12 **Identification number** 1998-105 **Rating software (name and version used)** REM/Rate - v12.96 **Estimated annual energy costs($)** 2021 Do you want this on the E-Scale? Yes No **Estimated average monthly energy cost ($)** 168 Do you want this on the E-Scale? Yes No
Estimated annual energy use 10179 kWh (Electric) 920 Therms (Natural Gas)	**Estimated annual energy savings (relative to reference home)** 3353 kWh (Electric) 1210 Therms (Natural Gas)
Energy cost rates 0.09 $/kWh 0.90 $/Therms	**Estimated emissions reductions (relative to reference home)** 9.9 tons of Carbon Dioxide (CO2) 13.5 lbs of Sulfur Dioxide (SO2) 29.4 lbs of Nitrogen Oxides (NOx)

For more information on the Builders Challenge, visit: www.buildingamerica.gov/challenge

Building America U.S. Department of Energy Research Toward Zero Energy Homes

Builders Challenge

Recognizing Energy Leadership in Homebuilding

QUALITY CRITERIA CHECKLIST

☐ As the Third-Party verifier for this house, I certify that the house complies with all the 'Required' Builders Challenge Quality Criteria, as defined by the Builders Challenge Quality Criteria Checklist

ADDITIONAL INFORMATION

House will be certified under these programs (check all that apply):

☐ ENERGY STAR

☐ Environments for Living

☐ LEED for Homes

☐ National Green Building Standard

Appendix C: Cobblestone Homes REM/Rate

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

ENERGY STAR VERSION 2.5 HOME REPORT

Date:	January 25, 2012	Rating No.:	
Property:		Rating Org.:	Building Knowledge, Inc.
		Rater's Name:	Patrick O'Malley
Builder's Name:	Cobblestone Homes	Rater's ID:	1998-105
Building Name:	BA Cobblestone	Rating Date:	1/24/12

Normalized, Modified End-Use Loads (MMBtu/year)

	ENERGY STAR	*As Designed*
Heating:	57.6	36.0
Cooling:	15.0	10.7
Water heating:	14.8	12.5
Lighting & Appliances:	37.5	42.6
Total:	124.8	101.8

HERS Index of Reference Design Home	**63**	**52**	**HERS Index w/o PV**
HERS Index Target (SAF Adjusted)	**58**	**52**	**HERS Index**
Size Adjustment Factor:	**0.92**		

HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

Mandatory Requirements for All ENERGY STAR Version 2.5 Qualified Homes

- [X] Duct leakage to outside < 6 CFM25 per 100 sq.ft. of conditioned floor area, per duct system.
- [ ] Envelope insulation levels meet or exceed ENERGY STAR v3.0 requirements. (Not Required for Version 2.5!)
- [X] Slab on Grade Insulation > R-5 at IECC 2009 Depth, Climate Zones 4 & above. (Not Required for Version 2.5!)
- [ ] Envelope insulation achieves RESNET Grade I installation or Grade II w/sheathing. (Not Required for Version 2.5!)
- [X] Windows meet the 2009 IECC Requirements - Table 402.1.1. (Not Required for Version 2.5!)
- [X] Duct insulation meets the EPA minimum requirements of R-6. (Not Required for Version 2.5!)
- [X] Mechanical ventilation rate is within 100-120% of ASHRAE 62.2-2010 values. (Informational only; Not Required)
- [X] ENERGY STAR Checklists verified and complete. (Not Required for Version 2.5!)

This home MEETS OR EXCEEDS the energy efficiency requirements for designation as an EPA ENERGY STAR Version 2.5 Qualified Home.

ENERGY STAR VERSION 2.5 HOME REPORT

BA Cobblestone Page 2

Pollution Prevented		Energy Cost Savings ($/year)	
Type of Emissions	*Reduction*	Heating:	$1101
Carbon Dioxide (CO2) - tons/yr	9.1	Cooling:	$146
Sulfur Dioxide (SO2) - lbs/yr	10.2	Water Heating:	$20
Nitrogen Oxides (NOx) - lbs/yr	26.4	Lights & Appliances:	$36
		Total:	$1304

The energy savings and pollution prevented are calculated by comparing the Rated Home to the ENERGY STAR Version 3 Reference Home as defined in the "ENERGY STAR Qualified Homes HERS Index Target Procedure for National Program Requirements, Version 3.0" promulgated by the Environmental Protection Agency (EPA). In accordance with RESNET Mortgage Industry National Home Energy Rating Systems Standards, building inputs affecting setpoints infiltration rates, window shading and the existence of mechanical systems may have been changed prior to calculating loads.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

ENERGY STAR VERSION 2.5 HOME VERIFICATION SUMMARY

Date:	January 25, 2012	Rating No.:	
Property:		Rating Org.:	Building Knowledge, Inc.
		Rater's Name:	Patrick O'Malley
Builder's Name:	Cobblestone Homes	Rater's ID:	1998-105
Building Name:	BA Cobblestone	Rating Date:	1/24/12

Building Information

Conditioned Area (sq ft):	3930
Conditioned Volume (cubic ft):	35370
Insulated Shell Area (sq ft):	6618
Number of Bedrooms:	4
Housing Type:	Single-family detached
Foundation Type:	Conditioned basement

Ratings

HERS Index:	52
HERS Index w/o PV:	52
HERS Index Target (SAF Adjusted):	58
HERS Index of Reference Design Home:	63
Size Adjustment Factor:	0.92

Building Shell

Ceiling w/Attic:	R-49 Blown, Attic U=0.021	Window/Wall Ratio:	0.14
Vaulted Ceiling:	None	Window Type:	U:0.30, SHGC:0.29
Above Grade Walls:	3" SPF, 6-16+R3 U=0.049	Window U-Value:	0.300
Found. Walls (Cond):	R5E R=5.0	Window SHGC:	0.290
Found. Walls (Uncond):	None	Infiltration:	Htg: 1.50 Clg: 1.50 ACH50
Frame Floors:	None	Duct Leakage to Outside:	19.65 CFM @ 25 Pascals
Slab Floors:	Uninsulated U=0.663	Total Duct Leakage:	250.00 CFM @ 25 Pascals

Mechanical Systems

Heating:	Fuel-fired air distribution, 66.0 kBtuh, 92.0 AFUE.
Cooling:	Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating:	Conventional, Gas, 0.65 EF.
Programmable Thermostat:	Heat=Yes; Cool=Yes
Ventilation System:	Balanced: ERV, 77 cfm, 100.0 watts.

Note: Where feature level varies in home, the dominant value is shown.

This home MEETS OR EXCEEDS the EPA's requirements for an ENERGY STAR Home.
HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2006 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Cobblestone	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Cobblestone Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Cobblestone_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2006 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	27.1
Above-Grade Walls:	157.6	133.4
Windows and Doors:	148.2	120.5
Basement Walls:	50.8	84.6
Overall UA (Design must be equal or lower):	390.9	365.6
Window U-Factor Check (Section 402.6)		
Window U-Factor (Design must be equal or lower):	0.400	0.300

This home MEETS the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2006 edition.) In fact, this home surpasses the requirements by 6.5%.

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R-49 Blown, Attic	0.021	1320.0
Above-Grade Walls			
Wall	3" SPF, 6-16 +R3	0.049	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.30, SHGC:0.29	0.300	155.6
Window	U:0.30, SHGC:0.29	0.300	33.6
Window	U:0.30, SHGC:0.29	0.300	97.6
Window	U:0.30, SHGC:0.29	0.300	94.6
Door	R5 steel insul, strm	0.144	21.0

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R5E	0.111	256.0
Wall	R5E	0.084	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2006 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Cobblestone	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Cobblestone Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Cobblestone_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2006 IECC	**As Designed**
Heating:	1444	609
Cooling:	135	99
Water Heating:	213	196
SubTotal - Used to Determine Compliance:	**1792**	**904**
Lights & Appliances:	903	955
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2959**	**2123** *

Window U-Factor Check (Section 402.6)		
Window U-Factor (Design must be equal or lower):	0.400	0.300

This home MEETS the annual energy cost requirements and verifications of Section 404 of the 2006 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 49.5%.

Name: Patrick O'Malley Signature:

Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 92.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating: Conventional, Gas, 0.65 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 1.50 Clg: 1.50 ACH50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set to the "prevailing federal minimum standards" as of January, 2009. These standards are subject to change, and software

updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2009 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Cobblestone	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Cobblestone Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Cobblestone_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2009 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	27.1
Above-Grade Walls:	149.7	133.4
Windows and Doors:	148.2	120.5
Basement Walls:	50.8	84.6
Overall UA (Design must be equal or lower):	383.0	365.6
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300

This home MEETS the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2009 edition.)

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R-49 Blown, Attic	0.021	1320.0
Above-Grade Walls			
Wall	3" SPF, 6-16 +R3	0.049	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.30, SHGC:0.29	0.300	155.6
Window	U:0.30, SHGC:0.29	0.300	33.6
Window	U:0.30, SHGC:0.29	0.300	97.6
Window	U:0.30, SHGC:0.29	0.300	94.6
Door	R5 steel insul, strm	0.144	21.0

REM/Rate - Residential Energy Analysis and Rating Software v12.96

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R5E	0.111	256.0
Wall	R5E	0.084	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2009 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Cobblestone	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Cobblestone Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Cobblestone_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2009 IECC	**As Designed**
Heating:	1190	696
Cooling:	137	122
Water Heating:	196	196
SubTotal - Used to Determine Compliance:	**1523**	**1014**
Lights & Appliances:	903	955
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2690**	**2233** *

Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300
Home Infiltration (Section 402.4.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

This home MEETS the annual energy cost requirements and verifications of Section 405 of the 2009 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 33.5%.

Name: Patrick O'Malley Signature:

Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 92.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating: Conventional, Gas, 0.65 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 1.50 Clg: 1.50 ACH50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2012 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2012 IECC OVERALL BUILDING UA COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Cobblestone	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Cobblestone Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Cobblestone_As Built.blg	Rating Date:	1/24/12

Elements	**Insulation Levels**	
	2012 IECC	As Designed
Shell UA Check		
Ceilings:	34.3	27.1
Above-Grade Walls:	126.1	133.4
Windows and Doors:	135.5	120.5
Basement Walls:	50.8	84.6
Overall UA (Design must be equal or lower):	346.6	365.6
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300

This home DOES NOT MEET the overall thermal performance requirements and verifications of the International Energy Conservation Code based on a climate zone of 6A. (Section 402, International Energy Conservation Code, 2012 edition.) In fact, this home is under the requirements by 5.5%.

Building Elements	**Type**	**U-Value**	**Area**
Ceilings			
Roof	R-49 Blown, Attic	0.021	1320.0
Above-Grade Walls			
Wall	3" SPF, 6-16 +R3	0.049	2332.6
Joist	Main	0.066	148.0
Joist	Upper	0.066	146.0
Windows and Doors			
Window	U:0.30, SHGC:0.29	0.300	155.6
Window	U:0.30, SHGC:0.29	0.300	33.6
Window	U:0.30, SHGC:0.29	0.300	97.6
Window	U:0.30, SHGC:0.29	0.300	94.6

Building Elements	Type	U-Value	Area
Door	R5 steel insul, strm	0.144	21.0
Door	R5 steel insul, strm	0.144	21.0
Basement Walls			
Wall	R5E	0.111	256.0
Wall	R5E	0.084	672.0

BUILDING KNOWLEDGE

BUILDING KNOWLEDGE

2012 IECC ANNUAL ENERGY COST COMPLIANCE

Date:	January 25, 2012	Rating No.:	
Building Name:	BA Cobblestone	Rating Org.:	Building Knowledge, Inc.
Owner's Name:	Northern STAR	Phone No.:	952-944-5605
Property:		Rater's Name:	Patrick O'Malley
Address:	,	Rater's No.:	1998-105
Builder's Name:	Cobblestone Homes		
Weather Site:	Minneapolis, MN	Rating Type:	Projected Rating
File Name:	Cobblestone_As Built.blg	Rating Date:	1/24/12

	Annual Energy Cost ($)	
	2012 IECC	**As Designed**
Heating:	960	695
Cooling:	154	135
Water Heating:	196	196
SubTotal - Used to Determine Compliance:	**1310**	**1026**
Lights & Appliances:	903	955
Photovoltaics:	-0	-0
Service Charge:	264	264
Total:	**2477**	**2245** *

Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.400	0.300
Home Infiltration (Section 402.4.1.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

This home MEETS the annual energy cost requirements and verifications of Section 405 of the 2012 International Energy Conservation Code based on a climate zone of 6A. In fact, this home surpasses the requirements by 21.7%.

Name: Patrick O'Malley Signature:

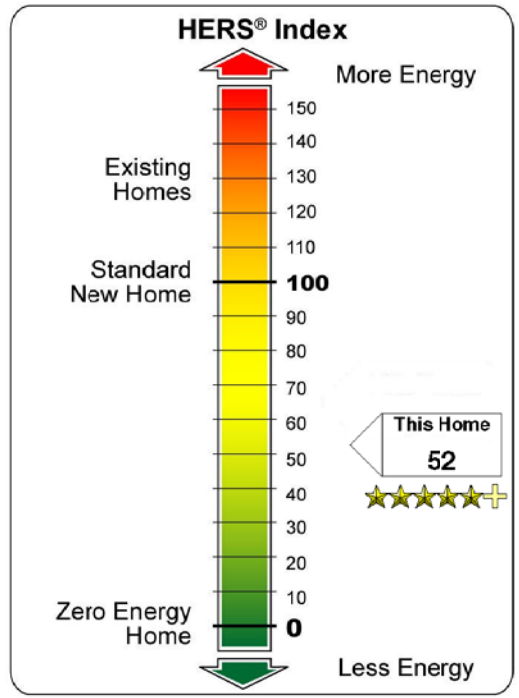
Organization: Building Knowledge, Inc. Date: January 25, 2012

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 66.0 kBtuh, 92.0 AFUE.
Cooling: Air conditioner, 30.0 kBtuh, 13.0 SEER.
Water Heating: Conventional, Gas, 0.65 EF.
Window-to-Floor Area Ratio: 0.10
Blower door test: Htg: 1.50 Clg: 1.50 ACH50

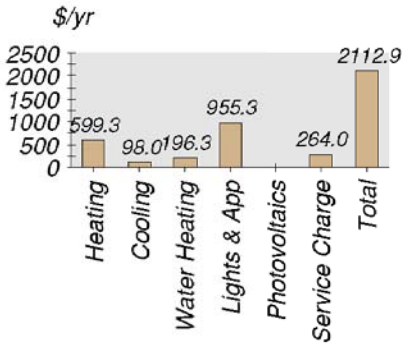
In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed prior to calculating annual energy cost. Furthermore, the standard reference design HVAC system efficiencies are set equal to those in the design home as specified in the 2009 IECC. These standards are subject to change, and software updates should be obtained periodically to ensure the compliance calculations reflect current federal minimum standards.

PERFORMANCE WITH ENERGY S

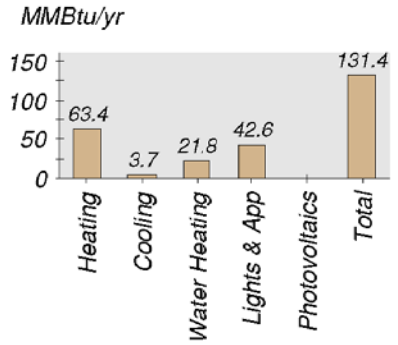
ENERGY RATING CERTIFICATE



Estimated Annual Energy Cost



Estimated Annual Energy Consumption



Address:

House Type: Single-family detached
Cond. Area: 3930 sq. ft.
Rating No.:
Issue Date: January 25, 2012

Annual Estimates*:
Electric(kWh): 10999
Natural gas(Therms): 939
C02 emissions(Tons): 14
Annual Savings**: $2250

** Based on standard operating conditions*
*** Based on a HERS 130 Index Home*

Building Knowledge, Inc.
PO Box 1376

Certified Rater: Patrick O'Malley
Certification No: 1998-105
Rating Date: 1/24/12

REM/Rate - Residential Energy Analysis and Rating Software v12.96
This information does not constitute any warranty of energy cost or savings. © 1985-2011 Architectural Energy Corporation, Boulder, Colorado
The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING KNOWLEDGE

Home Energy Rating Certificate

5 Stars Plus
Projected Rating

Uniform Energy Rating System						Energy Efficient			
1 Star	1 Star Plus	2 Stars	2 Stars Plus	3 Stars	3 Stars Plus	4 Stars	4 Stars Plus	5 Stars	5 Stars Plus
500-401	400-301	300-251	250-201	200-151	150-101	100-91	90-86	85-71	70 or Less

HERS Index: 52

General Information

Conditioned Area:	3930 sq. ft.	HouseType:	Single-family detached
Conditioned Volume:	35370 cubic ft.	Foundation:	Conditioned basement
Bedrooms:	4		

Mechanical Systems Features

Heating:	Fuel-fired air distribution, Natural gas, 92.0 AFUE.
Cooling:	Air conditioner, Electric, 13.0 SEER.
Water Heating:	Conventional, Natural gas, 0.65 EF, 50.0 Gal.
Duct Leakage to Outside:	19.65 CFM.
Ventilation System:	Balanced: ERV, 77 cfm, 100.0 watts.
Programmable Thermostat:	Heating: Yes Cooling: Yes

Building Shell Features

Ceiling Flat:	R-49	Exposed Floor:	NA
Vaulted Ceiling:	NA	Window Type:	U:0.30, SHGC:0.29
Above Grade Walls:	R-23	**Infiltration:**	
Foundation Walls:	R-5.0	Rate:	Htg: 1.50 Clg: 1.50 ACH50
Slab:	R-0.0 Edge, R-0.0 Under	Method:	Blower door test

Lights and Appliance Features

Percent Fluorescent Pin-Based:	10.00	Clothes Dryer Fuel:	Natural gas
Percent Fluorescent CFL:	30.00	Range/Oven Fuel:	Natural gas
Refrigerator (kWh/yr):	551.00	Ceiling Fan (cfm/Watt):	0.00
Dishwasher Energy Factor:	0.62		

The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

REM/Rate - Residential Energy Analysis and Rating Software v12.96

Rating Number:
Certified Energy Rater: Patrick O'Malley
Rating Date: 1/24/12
Rating Ordered For: Northern STAR

Estimated Annual Energy Cost
Projected Rating

Use	MMBtu	Cost	Percent
Heating	63.4	$599	28%
Cooling	3.7	$98	5%
Hot Water	21.8	$196	9%
Lights/Appliances	42.6	$955	45%
Photovoltaics	-0.0	$-0	-0%
Service Charges		$264	12%
Total		**$2113**	100%

This home meets or exceeds the minimum criteria for all of the following:

EPA ENERGY STAR Version 2 Home
EPA ENERGY STAR Version 2.5 Home
2006 International Energy Conservation Code
2009 International Energy Conservation Code

Building Knowledge, Inc.
PO Box 1376
Burnsville, MN 55337
952-944-5605
www.buildingknowledge.com

BUILDING KNOWLEDGE

Builders Challenge
Recognizing Energy Leadership in Homebuilding

EnergySmart Home Scale
QUALIFICATION FORM: PERFORMANCE PATH

Third-Party Verifiers should complete form and submit to:

MAIL: Builders Challenge, 3760 Tanglewood Lane, Davidsonville, MD 21035

EMAIL: builderschallenge@newportpartnersllc.com **FAX:** 301-889-0019

ENERGY PERFORMANCE	
HouseType Single-family detached	**Building Plan Number**
Year built 2012 (Homes completed in 2007 or later may qualify if they meet the energy threshold and a third-party verifier can verify the Quality Criteria)	**Square footage of conditioned space** 3930.0 **Number of Bedrooms** 4
Site address (if not available, list the site Lot#)	**E-Scale Mailing Address (where E-Scale will be mailed)** Attn: Patrick O'Malley PO Box 1376 Burnsville, MN 55337 952-944-5605
Registered Builder Cobblestone Homes	**Developer (if known)**
Third Party Verifier Building Knowledge, Inc. Patrick O'Malley 952-944-5605 pato@buildingknowledge.com www.buildingknowledge.com	**E-Scale Score/ HERS Index (70-0)** 52 **Date of Rating** 1/24/12 **Identification number** 1998-105 **Rating software (name and version used)** REM/Rate - v12.96 **Estimated annual energy costs($)** 2113 Do you want this on the E-Scale? Yes No **Estimated average monthly energy cost ($)** 176 Do you want this on the E-Scale? Yes No
Estimated annual energy use 10999 kWh (Electric) 939 Therms (Natural Gas)	**Estimated annual energy savings (relative to reference home)** 2532 kWh (Electric) 1194 Therms (Natural Gas)
Energy cost rates 0.09 $/kWh 0.90 $/Therms	**Estimated emissions reductions (relative to reference home)** 9.1 tons of Carbon Dioxide (CO2) 10.2 lbs of Sulfur Dioxide (SO2) 26.4 lbs of Nitrogen Oxides (NOx)

For more information on the Builders Challenge, visit: www.buildingamerica.gov/challenge

Builders Challenge
Recognizing Energy Leadership in Homebuilding

QUALITY CRITERIA CHECKLIST

☐ As the Third-Party verifier for this house, I certify that the house complies with all the 'Required' Builders Challenge Quality Criteria, as defined by the Builders Challenge Quality Criteria Checklist

ADDITIONAL INFORMATION

House will be certified under these programs (check all that apply):

☐ ENERGY STAR

☐ Environments for Living

☐ LEED for Homes

☐ National Green Building Standard

buildingamerica.gov

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE/GO-102012-3754 ▪ December 2012