



AHIP: GREEN NEIGHBORHOOD

Sustainable Methods for AHIP Practices

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TABLE OF CONTENTS

Abstract.....	3
Introduction.....	3
Body	
EarthCraft.....	3
Passive House.....	6
Energy Star.....	7
Qualitative Comparison Chart.....	9
Conclusion.....	10
Future Work (Timeline).....	10
Lessons Learned.....	11
Budget and Acknowledgments.....	11
Bibliography.....	12

ABSTRACT

The goal of this project is to research some of the most well known up-and-coming sustainability building techniques, LEED, Passive House, EarthCraft, and Energy Star, in order to assess whether they would be beneficial for the Albemarle Housing Improvement Program (AHIP) to incorporate into their business plan. The possible benefits for supporting these sustainability measures are incentives such as tax breaks and/or new potential clients. With the current economic times, both of these possibilities are extreme positives for AHIP. Our team's goal, over the course of the semester, was to research the pros and cons of EarthCraft, Passive House, and Energy Star, in order to present AHIP with ideas as to how they could benefit their clients while also benefiting themselves. When we met with the LEED group during the course of the semester, both our team and theirs came to the conclusion that ReGreen was the best option for AHIP if they wish to pursue sustainability in their renovations. While the other methods were potentially feasible for AHIP, they were generally outside of their scope of work; ReGreen still provides the many of the sustainable measures of the others that were researched; the downside is the lack of certification and tax credit. However, should AHIP wish to consider ReGreen, they will be able to provide a better service to their clientele, as well as benefit not only our community, but our planet.

INTRODUCTION

The idea behind our research of sustainable building practices is to see whether new investors could be swayed to donate money, time, or resources thanks to alternative and innovative methods. Therefore, we have chosen to research the differences between LEED, Earthcraft, Passive House, and Energy Star. These sustainable certification methods/programs will give us a good idea as to the market's opinion of "green" measures. Determining this view will go a long way towards providing AHIP with a uniform and responsible decision as this general attitude will illustrate the willingness of businesses to donate. Therefore, we are looking for the method which guarantees the most sustainable project and at the same time yields the most investment to ensure that AHIP can remain a productive nonprofit.

We continued to follow the process laid out in our Conceptual Design. After providing research for each method, we ranked them using a chart we created to compare and contrast each option. After this we took our findings to the LEED group and discussed which method we would like to present to AHIP. With guidance from Nick Wickersham, our two groups will give a combined presentation to AHIP at the semester's close, which will hopefully enable them to make an educated decision. We were on schedule with our desired goal at the time of our preliminary report submission. Refer to the Timeline (p. 13) below for an accurate depiction of current progress.

SUSTAINABLE BUILDING DESIGNS

EARTHCRAFT

What is EarthCraft?

In today's world, we deal with many issues pertaining to our environment. Any way possible to contribute to this movement of "going green" is beginning to catch on around the global community. People have begun to transition away from the philosophy that nature is here to serve us, and moved towards more of an equal relationship. Since residential construction accounts for close to 21 percent of the nation's energy use, this philosophy has begun to take hold in the construction sector as well (Energy Star). This is where EarthCraft begins to surface as it, like LEED or Passive House, is a standard for green building. Although EarthCraft

takes on many different forms, for example commercial, communal, etc., we will focus on the renovation and affordable housing sector. Those two will encompass the majority of the policy and administrative items necessary for AHIP's purpose. EarthCraft's purpose in these two disciplines is to insure that the homes deliver energy, water and maintenance reductions, while creating a cleaner indoor atmosphere (EarthCraft).

Research for Ratings

As stated in previous submittals, there are certain criteria that we feel are particularly important to judging which sustainable program is the best option. These criteria are as follows: Tax Credit, Feasibility, Cost, Value of Home, Time, Grants, Ease of Maintenance, Living Conditions, and Federal Rebates. All of these categories hold an important part to why these programs should or should not be instituted for AHIP. It is understood that because these programs are relatively new- only in existence for ten years or so- that a lot of the information will come from their sites and studies. There will obviously be a bias present with that research, but the information will still be presented to allow AHIP access to the available information.

Value of Home and Cost

With AHIP in need of a community relations group who is in charge of creating a friendly relationship in the surrounding areas to possibly increase public relations and awareness of their services, the cost and value to the home is an optimal category with which to begin. The added value of a home will be one of the major selling points with regards to EarthCraft. Here is a chart that is from TLC, which discusses the savings that a homeowner will see if they have an EarthCraft house compared to a standard house.

	Standard New Home	EarthCraft Home
Home Price (Assume 10 percent down, 8 percent interest)	\$150,000	\$154,816
Loan Amount	\$135,000	\$139,334
Monthly Payment	\$991	\$1023
Energy Bills	\$186	\$93
True Monthly Cost	\$1177	\$1116
Monthly Savings	----	\$61

As one can see, EarthCraft does hold a higher initial cost, as construction tends to be of higher quality and care; however, Earthcraft is actually cheaper when factoring in energy costs. Another additional benefit of an EarthCraft house is the increase of an owner's liquidated assets. Not only will the monthly bills decrease with EarthCraft renovations, these renovations will also increase the value of the house. It is far more attractive to a potential buyer if a house is health-, Earth-, and cost-conscious (EarthCraft).

Ease of Maintenance

It is understood by a general homebuyer that maintenance will be necessary during their ownership. With EarthCraft, it has shown that less maintenance is required. On September 21, 2006, the President of the Home Builders Association of Virginia announced that they were joining with the Virginia Sustainable Building Network to bring Earthcraft to Virginia. In doing so they discussed the issues that an EarthCraft home would cost anywhere from 1-3% more than a traditional home, but would quickly off-set this new costs from annual savings in energy and maintenance costs (Graystone). Nevertheless, this program is relatively young, so AHIP must be careful when accepting this lower maintenance cost right now. Since EarthCraft building technology is young, there may not have been time for maintenance issues to appear. This point

may need to be evaluated more closely as the program ages, but as of right now, data show that EarthCraft renovations present a higher quality and more durable finished product.

Feasibility and Time

We feel that feasibility and time required for a project are two very large constraints for AHIP. Up front, all of our researched sustainable building methods have a lot of positives, but if none of them is feasible for a smaller nonprofit like AHIP, then the program is not worth it. This is where we see the largest drawback with EarthCraft. Not being involved in AHIP's day to day operations it is hard to accurately say, but based off of the certification requirements for EarthCraft it looks like it may prove difficult for AHIP to implement. First, the developers and builders would have to attend a training program at their local EarthCraft office. Since AHIP is a voluntary-based organization, we are not entirely sure if that means all individuals will have to attend, or whether AHIP would need to supply a certified builder for each phase of individual projects. Nonetheless and secondly, builders must be accepted to the local chapter, as well as the national chapter of the National Association of Homebuilders and the EarthCraft program (TLC). After this, building can commence, but is accompanied with several submissions and inspections to ensure the building certification. To score the renovation, a scorecard is used (like LEED) and a certain number of points are required for EarthCraft certification. The level of points required for renovations are as follows:

Points for Type of Renovation Required

- 100pts - renovations that do not add conditioned space
- 120pts - renovations that add conditioned space without changing exterior shell of building
- 140pts - renovations that change exterior shell of building but use only existing foundation
- 160pts - renovations that add a foundation

For AHIP builders to become qualified and for a project to be EarthCraft certified, a good deal of time and money is required, which may render this program to be infeasible.

Living Conditions

One of a EarthCraft home's major selling points is the improved living conditions. By producing a product that focuses on improving all factors of life, like efficiency and water and air quality, EarthCraft presents a product that outcompetes a standard house. In using the techniques that would allow AHIP's projects to become EarthCraft certified, they would ensure that their investment would make for a better final product and a generally happier customer. It is relatively obvious that the simplistic notion of reduced maintenance and health risks will be an attractive proposition to any homeowner.

Tax Credit and Federal Rebates

Tax credits and federal rebates are extremely important factors in AHIP's decision-making process. Since green housing and sustainable living is become such a hot topic in Washington right now, considerable amounts of money is available for such projects. Recently EarthCraft has been incorporated into the state Qualified Allocation Plan (QAP) (EarthCraft). This plan essentially gives federal money to Virginia in order to be allocated to qualified developments in order to reduce the associated costs (VHDA). Within QAP there is a section referring to the nonprofit allocation pool and also the requirement, submission, and awarding process. Additionally, there are also many other tax credits that can not only be awarded to AHIP, but to the homeowner as well. In Virginia and other states, there is a possibility of a \$500 state tax credit and a \$2000 federal tax credit for which homeowners are eligible, as well as rebates from power companies (TLC). This

information shows that there are certainly existing possibilities for a return on a “green” housing project, with the strong likelihood that the global interest will produce more available funding in the future.

PASSIVE HOUSE

What is Passive House

Passive House was founded in Germany in response to the increase in energy costs in the 1980s; the first prototype was built in 1990 (Kernagis). What sets Passive Houses apart from regular construction is their use of passive solar, air tightness, few to no thermal gaps, very high R-values for windows, doors, walls, ceilings, foundation, etc., and an energy recovery ventilation system.

New construction that is designed and built to Passive House specifications has a heating energy consumption that is just 10% of a standard home of similar dimensions; it has the highest energy efficiency standard in construction. Its applications include new construction- including residential, commercial, and institutional designs, and retrofitting existing structures. Generally it is difficult to retrofit a building to the standards that new construction can achieve, however using Passive House technology can still greatly improve energy efficiency and overall livability in preexisting structures. Passive House standards call for 15 kWh/m²a; retrofitting a building will lead to it's having a rating of less than 30 kWh/m²a (typical buildings have ratings of between 150-280 kWh/m²a).

Passive House, though inspired by projects in the United States, was founded in Germany and the vast majority of their projects remain in Europe. Since their beginning in 1990, more than 15,000 projects have been completed in Europe alone, including single and multi-family residences, schools, factories, and office buildings. In the US, however, it is still a relatively unheard of building practice. The Passive House Institute US (a 501c(3) nonprofit organization) documents 28 certified projects, though there are probably others that have yet to be listed.

In order to be certified by Passive House, a building must have these standards:

- . Airtight building shell ≤ 0.6 ACH @ 50 pascal pressure, measured by blower-door test. □
- . Annual heat requirement ≤ 15 kWh/m²/year (4.75 kBtu/sf/yr)
- . Primary Energy ≤ 120 kWh/m²/year (38.1 kBtu/sf/yr) □

In addition, the following are recommendations, varying with climate:

- . Window U-value ≤ 0.8 W/m²/K □
- . Ventilation system with heat recovery with $\geq 75\%$ efficiency with low electric consumption @ 0.45 Wh/m³
- . Thermal Bridge Free Construction ≤ 0.01 W/mK □

(Source: Passive House Institute US)

Value of Home and Cost

Constructing a Passive House versus a non-certified house costs about 10% more. However, this additional amount is earned back by the significant reduction in energy costs. Therefore, the upfront cost for constructing a Passive House or implementing its technology on a retrofit is significantly higher, though the long-term costs (i.e. energy bills, maintenance, etc) are reduced.

The value of the home is increased when certified as a Passive House. Retrofitting a pre-existing house to certain Passive House criteria (it is virtually impossible to fully meet Passive House requirements in

renovations) would most likely increase the value of the home as well.

Ease of Maintenance

Passive House technology hasn't been around long enough to really study its ease of maintenance as compared to a normal house. However, due to its very solid design and airtightness, the risk for mold buildup and condensation in the walls is substantially reduced.

Feasibility and Time

The feasibility for AHIP to implement Passive House technology on their renovation projects is possible, though probably not practical. Adding an additional 10% to the cost of new construction, that figure would probably increase for retrofit projects.

The time required to implement Passive House technology is greater than standard construction, especially for those unfamiliar with the process; builder training and certification is required.

Living Conditions

The living conditions of a Passive House (or a retrofitted one) are greatly improved. Drafts are eliminated, air quality is exceptionally high, and maintaining a comfortable interior temperature is simple and very cost effective.

Tax Credits and Rebates

Passive Houses are often able to garner LEED points as well as Energy Star ratings. There are federal and state rebates and tax credits for Energy Star appliances and LEED design, as well as for implementing sustainability and energy efficiency into building design.

Passive House Conclusion

There is very little hard data available for Passive Houses. As it is primarily a European trend and there are only a small number of Passive Houses in the US, it is difficult to determine concrete numbers. However, it is certain that building to Passive House standards or retrofitting a pre-existing structure with Passive House technology will increase livability, greatly reduce energy costs and carbon footprint, and will increase the value of the home.

ENERGY STAR

What is Energy Star?

Energy Star is a program of the U.S. Environmental Protection Agency and the U.S. Department of Energy with goals aimed at protecting the environment through energy efficient products and practices. Recently, Energy Star has been expanded to include new construction. Energy Star certified homes are at least 15 percent more efficient than standard houses built to the IRC code of 2004, and incorporate other energy-saving features that generally increase their efficiency to 20-30 percent (EnergyStar). Americans, with the help of Energy Star, saved enough energy in 2010 alone to avoid greenhouse gas emissions equivalent to those from 33 million cars, while saving nearly \$18 billion on their utility bills. Energy efficient choices can save families about a third on their energy bill with similar savings of greenhouse gas emissions, without sacrificing style or comfort. It also should be mentioned that Energy Star also is involved with businesses, helping to cut energy costs and increase profits.

Value of Home

Considering the majority of clients with whom AHIP becomes involved have preexisting houses that require rehabilitation, the value of the home will depend on how many Energy Star appliances they choose to incorporate. However, the Environmental Protection Agency did find that a home's value rises an average of \$20 for each \$1 decrease in the annual utility bill. Details of how each individual appliance affects energy savings can be found below.

Feasibility and Time

The feasibility of including Energy Star appliances all depends on the budget with which AHIP has to work. If they have the money available, they can implement Energy Star; the premium of Energy Star appliances typically range from \$50-\$200 above standard appliances. The time involved with implementation is inconsequential as it is the same amount that would be necessary for installing a non-Energy Star device. If whole-house efficiency upgrades are made, the time necessary for such work will vary depending on the project.

Quality of Living

Energy savings are only part of the story with Energy Star. Energy Star is an innovative whole house approach to improving the comfort and energy efficiency of existing homes. Qualified contractors provide a complete home assessment and recommend ways to improve its energy efficiency. They can install insulation, do air-sealing, and verify that heating and cooling equipment and ductwork are operating safely and efficiently. One Energy Star user who's family had developed asthma and other health problems due to lack of insulation said "I killed three birds with one stone—our comfort level dramatically increased, our utility bills dramatically decreased, and our health problems were solved."

Tax Credit and Federal Rebates

Knowing that it will take incentives to make people switch from their preexisting appliances to Energy Star appliances, there are plenty of incentives to financially help people make the switch. Federal Rebates are available; the Energy Star website has a generator to inform homeowners for which rebates they qualify.

Biomass stoves, heating ventilating a.c., insulation, roofs, water heaters, windows and doors

Tax Credit: 10% of cost up to \$500 or a specific amount from \$50 - \$300

Expires: December 31, 2011

Details: Must be an existing home & your principal residence. New construction and rentals do not qualify.

Geothermal Heat Pumps, small wind turbines, solar energy systems

Tax credit: 30% of cost with no upper limit

Expires: December 31, 2016

Details: Existing homes & new construction qualify. Both principal residences and second homes qualify. Rentals do not qualify.

Fuel Cells

Tax Credit: Credit Details: 30% of the cost, up to \$500 per .5 kW of power capacity

Expires: December 31, 2016

Details: Existing homes & new construction qualify. Must be your principal residence, Rentals and second homes do not qualify.

Energy Star Conclusion

Energy Star is unique in that AHIP can incorporate as much or as little of it as it wants. Since we are helping AHIP with home improvement, and not the building of new homes, Energy Star only involves the idea of adding Energy Star appliances, though energy savings can also be gained by sealing drafty windows and doors, adding insulation to attics, etc. Despite Energy Star appliances being more expensive, it has been shown that they quickly pay for themselves when cutting utility bills; adding insulation and caulking will vary in cost and time demands.

QUALITATIVE COMPARISON CHART BETWEEN EARTH CRAFT, PASSIVE HOUSE, ENERGY STAR, AND LEED

Below is the chart that was used to help both the LEED and Alternative Program groups decide which sustainable program should be recommended to AHIP. In the chart, all categories are qualitatively compared to the baseline values for traditional housing. Following the chart are the results and decisions that were made in response to AHIP's desire to potentially adopt a sustainable program.

Sustainable Programs

	EarthCraft	Passive House	Energy Star	LEED
Tax Credit	Yes	Yes	Yes	Yes
Feasibility	Moderate	Difficult	Easy	For major renovation
Cost	Reduces Monthly Costs	10% additional; dramatically reduces energy costs.	Upfront cost higher, rebates reduce cost	Initial Cert. Implementation Cost
Value of Home	Increases	Increases	Increases	Increases
Time	More	More	n/a	More
Grants	Potential	Potential	Potential	Potential
Maintenance	Easy	Easy	Normal	Difficult
Living Conditions	Extreme Improvement	Improves	Improves	Improves
Federal Rebates	Available	Applicable for certain components	Available	Potential

*All compared to Traditional Housing

CONCLUSION

After our individual research into Passive House, Earthcraft, and EnergyStar certifications, and later, discussing our findings with the LEED group, we (our group as well the LEED group) have decided that the only viable option for AHIP, if they choose to pursue a sustainable building practice, is LEED's ReGreen. ReGreen is designed specifically for sustainable renovations of pre-existing houses and, like the other LEED certifications, is a point-based system.

This decision has been emphasized by our conversation with John Semmelhack, a local expert on Passive House, Earthcraft, and deep-energy retrofitting. When asked about renovation certification for AHIP, he stated that for Passive House it would be very difficult; Earthcraft wouldn't be as much of a challenge, but would potentially still be out of AHIP's range. An example of EarthCraft's potential price range is a renovation of an apartment building that was recently finished in Lynchburg, Virginia. While most of the positive attributes surfaced (reduced energy use, etc.), the project still cost \$8.9 million dollars to perform. Adding EnergyStar appliances alone would save significant energy at very little extra cost; EnergyStar certification for houses is only relevant for new construction. Though having these certifications would add a lot of value to any renovated house, the extra work and certification adds to the budget. For renovations, this cost varies, but for new construction of smaller family homes, implementation of the Passive House technology will add 6-12 percent, though the energy savings pays for this extra cost in a couple years. Also, it is more difficult for smaller houses to receive Passive House certification as ratings are based on the heat gain/loss per square foot. Implementation of Passive House technology, however, is not only for the elite or very green-minded: Germany has recently made the Passive House design standard their national building code (Green Building Trends).

Semmelhack did suggest that AHIP look into joining the Thousand Homes Challenge, sponsored by the Affordable Comfort Institute. This challenge offers the chance for homeowners to do deep energy retrofits for pre-existing homes, with potential to reach 70 percent or more in energy savings. Lastly, Semmelhack mentioned that there are many rebates to be had for sustainable renovations. Though individual certifications are eligible for certain rebates, there is also a lot of cross over. In 2005, Congress passed the Energy Policy Act (EPACT) (Greening Existing Buildings). With many pieces of this legislature extended for many years, EPACT offers substantial tax credits and rebates to both homeowners and builders. Locally, LEAP, the Local Energy Alliance Program, offers help with retrofits. Semmelhack suggested that AHIP may want to just work with LEAP.

FUTURE WORK

As stated in the Conceptual Design, we decided to split up the individual methods for research. The responsibilities were split up in the following manner:

Eric Thornton – EarthCraft
William Quinn – Energy Star
Susannah Cadwalader – Passive House

Conceptual design: 10/5

Project presentations: 10/13

- Give a general overview of what we are researching and the various factors we are taking into consideration.
- Preliminary report: 11/2
- Have all the necessary data compiled into readily understandable/comparable spreadsheets
- Between 11/2 and 12/5: Work with the LEED group to assimilate our findings.

- Between 11/2 and 12/5: Compile a comparative report on LEED/Passive House/ Earthcraft/ Energy Star.

Final report: 12/10

- Make a powerpoint presentation and have specific points for each group member to discuss.

Final presentations: 12/12

AHIP will make final decision for adoption. (On their own time)

*Highlighted portion is timeline work completed

There is not much follow-up work required on our end. Our job through the course of the semester was to research the different possible methods of sustainable construction. Once a decision was made between the LEED group and our group, it is AHIP's responsibility to take the information and use it to make a decision. This will happen on AHIP's own deadline, and will not need the future assistance of our group.

LESSONS LEARNED

The toughest barrier that we had to overcome throughout the process was the ability to give AHIP an intelligent response. That seems elementary, but when we look at the problem, we can see that presenting AHIP with a solution on a topic on which they probably already know more than us, is difficult. We were able to resolve this issue by simply providing some creative research, and producing an in depth solution with which we feel AHIP will be happy. When we reflected back on the semester's goals, we concluded that we met all of them. We set out to produce research that AHIP could take and use to formulate an intelligent business strategy. If we were to attempt to go through this process again, we believe that working directly with AHIP would be best. During this project, a lot of our communication between AHIP and ourselves was wired through our TA. This caused for things to be lost in translation, or for AHIP objectives to remain unclear. This was the way AHIP wanted it set up, but after doing the project, we believe direct communication would be best.

BUDGET AND ACKNOWLEDGEMENTS

There was no necessary budget for this project. All work was research based.

We would like to thank the members of AHIP, Ravi Respeto and Joyce Dudek, for taking the time out of their busy schedules, and we hope that the aforementioned information will serve AHIP well. We would also like to thank Nicholas Wickersham for helping guide us in a direction that will, we hope, give AHIP the desired documentation. Lastly, we would like to acknowledge John Semmelhack for providing his knowledgeable opinion on sustainable building methods.

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