

2008 Innovations Awards Program APPLICATION

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ID # (assigned by CSG): 08-S-34NC

Please provide the following information, adding space as necessary:

State: North Carolina

Assign Program Category (applicant): Natural Resources: Energy (Use list at end of application)

1. Program Name
Upgrade and Save: Heat Pumps in Manufactured Homes
2. Administering Agency
State Energy Office, N.C. Department of Administration
3. Contact Person (Name and Title)
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9. Please provide a two-sentence description of the program.

The Upgrade and Save program provides incentives to retailers so that purchasers of HUD-Code manufactured homes can install heat pumps as their primary heating source, instead of electric resistance heating systems, to achieve an annual average winter heating cost reduction of approximately \$643 per home per year. Since its inception in 2003, the program has upgraded 442 manufactured homes to heat pumps and recorded a cumulative savings of \$721,446 for the participating homeowners.

10. How long has this program been operational (month and year)? Note: the program must be between 9 months and 5 years old on March 1, 2008 to be considered.

The Upgrade and Save: Heat Pumps in Manufactured Homes began with a pilot project at Greenville Utilities Commission in Greenville, NC, in June 2003.

11. Why was the program created? What problem[s] or issue[s] was it designed to address?

The Heat Pumps in Manufactured Homes: Upgrade and Save program was created in 2003 to address the issue of high electric energy usage and cost in HUD-Code manufactured homes (formerly referred to as mobile homes) in eastern North Carolina. A high percentage of the new homes sited annually in our State are manufactured homes. Some sources have estimated the total at almost one-third statewide with even higher concentrations in the most rural areas of the state.

Since manufactured homes are built in a factory and then delivered to permanent home site, federal (HUD-Code) regulations require the installation of a heating system while the home is being constructed in the manufacturing plant. Because of lower first-costs, simplified installation processes and statewide availability of electric utility connections, most manufacturers install forced air electric furnaces in the homes that they build. The duct system/connections are designed and installed to accept either air conditioning and/or a heat pump without undue modifications or expense to the home owner. The central air conditioning or a heat pump is installed after the home is permanently sited.

Although forced air electric-resistance furnaces have a lower first-cost, they are typically two to three times more expensive to operate than a heat pump. The home owner's electric charges could be \$200 to \$300 higher per month in the winter months. Many customers choose manufactured homes because they offer an inexpensive housing option for their families; however, the benefits of lower a monthly mortgage payment are often negated by the higher monthly operating costs of an electric-resistance furnace. In some instances, the monthly winter utility payment may actually be higher than their monthly mortgage payment.

North Carolina's humid summer climate strongly influences the installation of air conditioning in most residences and manufactured homes reflect that influence. Both air conditioning systems and heat pump systems utilize a pressurized refrigerant system operating through a compressor to produce cool or warm air. In fact, a heat-pump is a central air-conditioning system engineered to use a refrigerant reversing valve which allows it to provide efficient low-cost heating from the same single compressor. In addition, the increased cost of a heat pump unit versus a central air conditioning unit is minimal and actual installation expenses are about the same for both.

The approximate cost of upgrading a manufactured home from the standard forced air electric resistance furnace with central air-conditioning to an energy-efficient heat pump (to provide both heating and cooling) is now approximately \$700 per home. When the home is upgraded to a heat pump, the forced air furnace is left in place and incorporated into the system. The furnace "closet" is used to house the heat pump's refrigerant coil (usually referred to as an "A coil"), while the furnace's electric resistance heating strips are utilized as an auxiliary or back-up heat source for the heat pump.

The Heat Pumps in Manufactured Homes: Upgrade and Save program, working through contractors at Greenville Utilities Commission, East Carolina University, NC A&T State

University and Appalachian State University, has reduced the number of new manufactured homes with electric-resistance furnaces as a heating source by:

- Offering a strong energy efficiency educational component to inform manufactured home buyers, retailers, suppliers and heating/air conditioning installers about the advantages of installing energy efficient heat pumps in manufactured homes;
- Verifying the heat pump installation and offering heat pump operational training and information to the participating home owners;
- Providing reimbursements (for the cost difference between electric furnaces with central air conditioning and energy-efficient heat-pumps) directly to the new home retailers;
- Providing reimbursements (of up to one-half of the costs needed to upgrade to energy-efficient heat-pumps) to home owners of recently-sited existing manufactured homes; and
- Increasing the statewide saturation the program from one eastern North Carolina County to its current level of 62 counties from the Atlantic coast to the western NC mountains.

Additional benefits of the Upgrade and Save: Heat Pumps in Manufactured Homes include a reduction of emissions created by the associated energy savings and the positive economic impact of lower utility bills on low to moderate income manufactured home owners.

12. Describe the specific activities and operations of the program in chronological order.

June 2003: Because of numerous high winter electric bill complaints from Greenville Utilities Commission (GUC) customers living in HUD-Code manufactured homes with electric resistance heating systems; the State Energy Office initiated a contract with GUC to address and solve the problem. Because of manufactured housing's relatively low first-cost, it fits well in the SEO's Low Income Residential Program (LIRP) and within our State Energy Plan (SEP). Specifically, the project supports SEP Recommendation #14 to "address energy-efficient housing in the low-income sector" and SEP Recommendation #18 to offer "outreach programs for consumer questions about saving energy".

This initial pilot program, to install heat pumps in new manufactured homes located in Greenville, NC and surrounding Pitt County, became the basis for "Upgrade and Save." GUC found that:

- Manufactured home retailers were the primary decision-makers in choosing whether or not to install heat pumps in new manufactured homes;
- Both new and existing homes with high winter electric bills had electric resistance heating systems and not heat pumps;
- Neither manufactured home retailers nor potential purchasers were aware of the energy saving potential and/or proper operation of heat pumps;
- By paying the cost difference (approximately \$400) between an electric furnace with central air conditioning and a heat pump to the retailer, they could increase the number of heat pumps installations; and
- Heat pump education for the homeowner would improve the system's operation and lower winter electric heating bills.

June 2004: At the close of the contract, 17 heat pump installations had been completed. Five of these were installed in existing manufactured homes which were originally equipped with electric furnaces. To determine baseline savings:

- GUC compared billing histories from the five homes to the same homes, now with heat pumps; and
- They found an average electric energy savings of approximately \$600 per winter heating season per home.

During the contract period, manufactured home retailers outside of the GUC service territory began inquiring about participation in the program. After discussions with GUC, it was determined that:

- A broader scope would increase program participation
- An alliance with East Carolina University (ECU) in Greenville, NC, as an alternative contractor was suggested. Using ECU as the contractor would allow:
 - Participation by additional retailers and utilities;
 - Provide field experience for its graduate school students; and
 - Offer academic verification/modeling for energy saving assumptions.

The GUC contract achieved the following results:

- Total annual average winter energy savings for the 17 upgraded homes is **\$10,931**;
- Increased retailer and customer awareness of the value of heat pumps; and
- Seventeen satisfied, comfortable and energy efficient homeowners.

August 2004: A contract was executed with East Carolina University's College of Technology and Computer Science to continue and expand "Upgrade and Save." ECU chose to continue using the GUC Project Manager to administer its contract. The project's scope now increased to cover Pitt and the surrounding 10 eastern North Carolina counties. ECU agreed to complete the following:

- Design a program that includes proper sizing and installation of the heat pump;
- Develop and implement promotional materials to inform and educate retailers and consumers on the advantages of a heat pump;
- Inspect homes to verify all system components are installed properly and operate as designed;
- Collect energy use data from homeowner participants to verify energy savings; and
- Monitor the disbursement of funds used to support the upgrades
- Provide monthly updates and a final project report.

June 2005: East Carolina University verified the installation of 131 heat pump upgrades during this first contract. They worked with 20 manufactured home retailers who sited the homes in over 60 different communities across eastern North Carolina.

ECU also addressed energy savings from the heat pump homes with calculations based on actual temperature measurements and the actual energy consumption collected from 14 of the homes. In addition, the data collected from an analytical model was created to simulate the energy consumption and the heating costs for one of the manufactured homes. The model was validated with temperature measurements. This exercise resulted in an energy saving per home during the winter heating season of 7,230kWh. The ECU calculations are summarized as follows:

- The number of operating hours =11 hrs/day;
- The average electrical energy consumption used for heating per day = 26.8 kWh;
- Energy used for heating per home per month=26.8*30= 805 kWh;
- Average electrical consumption during the season per home =1540 kWh;
- Percentage of electrical energy used for heating= 0.522;

- Energy consumption of electrical heating per month per home = $0.522 * 1540 * 2.5 = 2010$ kWh;
- Average kWh savings per month per home= 1205 kWh (NOTE: These results are based on the measurements and on the data collected from 14 manufactured homes, which is a relatively small sample. So, it has to be noted that the savings could be more than the 1205 kWh);
- kWh savings during the heating season per home= 7230 kWh/home;
- BTU savings during the heating season=24,669,772.2 BTU/home; and
- Average dollar savings per home per season= $7230 * 0.89/\text{kWh} = \underline{\$ 643}$.

This initial ECU contract achieved the following results:

- Total annual winter energy savings for the 131 upgraded homes is **\$84,233**;
- The average upgrade payment to the retailer was about \$490 per home;
- Established an analytical baseline for average annual savings for a heat pump upgrade.

August 2005: A second contract with East Carolina University was drawn to:

- Expand the scope from the previous 11 to 17 eastern North Carolina counties;
- Because of the U.S. Department of Energy's five year accounting true-up process, this contract was written for only six months;
- Interest in the program has risen to the point that 35 manufactured home retailers were now active participants; and
- ECU continued to address the tasks as outlined in their previous contract.

January 2006: During the six month duration of this second contract with ECU a total of 64 manufactured homes were upgraded to heat pumps.

ECU also surveyed manufactured home retailers in the contract area and found the following:

- 62% of the retailers actively supported the program;
- Approximately 70% of the new manufactured homes had heat pumps installed;
- 16% of the retailers sell heat pumps only and 27% sell half of their homes with heat pumps; and
- Most retailers expressed: a strong need for rebates (because of their customer's financial need); their desire to learn more about heat pumps and the added value associated with energy savings from heat pumps.

The second contract with ECU achieved the following results:

- Total annual winter energy savings for the 64 upgraded homes is **\$41,152; and**
- The average upgrade payment to the retailer was about \$570 per home.

May 2006: A third contract with East Carolina University was drawn to address the "gap funding", created by the previously noted Department of Energy's five year accounting true-up process, and to assure program continuity by:

- Maintaining the previous project's scope and tasks;
- Continuing the program's availability in the 17 eastern NC counties; and
- Being aware that the proposed minimum 13 SEER heat pump requirement will create additional costs for the upgrade.

September 2006: ECU verified the installation of 91 heat pump installations in 65 eastern North Carolina communities during this third contract.

- Total annual winter energy savings for the 91 upgraded homes is **\$58,513**.
- The average upgrade payment to the retailer was about \$627 per home.

September 2006, continued: The success of East Carolina University's "Upgrade and Save" program generated the interest of Appalachian State University in Boone, NC and resulted in a similar, current contract with them. Their original contract scope was for 14 counties in western North Carolina; however it has been amended twice and now includes all of the 30 NC counties west of the I-77 corridor.

Initially patterned after the ECU contract, ASU discovered that most of the manufactured home retailers in their contract area routinely installed heat pumps. This new information led ASU to change its primary focus to ENERGY STAR-labeled manufactured homes. In addition to requiring an energy-efficient heating system (i.e., a heat pump), ENERGY STAR-labeled manufactured homes:

- Have higher insulation requirements;
- More efficient windows;
- Sealed duct work;
- In-plant ENERGY STAR certification; and
- Energy savings of 30% over standard manufactured homes.

As a result of this new information, the contract was amended in June 2007 to offer a \$500 incentive to manufactured home retailers who sell an ENERGY STAR-labeled manufactured home. In addition, a small number of heat pump-only upgrades (up to \$700 each) are offered to manufactured home retailers who sell only the heat pump upgrade.

Appalachian State University worked with the NC Manufactured Housing Institute and the Manufactured Housing Research Alliance (the technical arm of the (national) Manufactured Housing Institute that certifies manufacturers to build ENERGY STAR labeled homes) to:

- Promote the construction of these more efficient homes with manufacturers;
- Visit a number of manufacturing plants to encourage them to build ENERGY STAR homes; and
- Contact western NC retailers to offer ENERGY STAR:
 - Training;
 - Educational materials; and
 - Consumer information.

To date, the ASU contract (scheduled to end in June, 2008) has achieved the following results:

- One manufacturer that now builds 100% ENERGY STAR;
- Eight ENERGY STAR homes have been installed; and
- Five ENERGY STAR home installations in western North Carolina are pending.

October 2006: East Carolina University's "Upgrade and Save" program generated the interest of yet another contractor, North Carolina Agricultural and Technical State University in Greensboro, NC, one of our state's historically black universities. Their interest resulted in an ECU-based similar, current contract that focuses on nine counties in piedmont North Carolina.

As with Appalachian State University, NCA&T found that most retailers in their contract area were already installing heat pumps. This information led to a contract amendment (similar to the

one at ASU) in June of 2007 that focused primarily on ENERGY STAR labeled manufactured homes along with a small number of heat pump only installations.

Since retailers receive manufactured homes from some of the same manufacturing plants, NCA&T has been working closely with ASU to raise the awareness of ENERGY STAR homes with retailers and manufacturers to increase the production of ENERGY STAR homes.

To date, the NCA&T contract (scheduled to end in June, 2008) has achieved the following results:

- Twenty-four heat pump upgrades equal annual winter energy savings of **\$15,432**; and
- Nine pending ENERGY STAR home installations in the piedmont region of North Carolina.

March 2007: A fourth contract was executed with East Carolina to continue, enhance and expand “Upgrade and Save.” While most of the project tasks and deliverables remained unchanged, the scope was modified to include:

- Increasing the financial incentive to the retailer (up to \$700 per upgrade) in support of the new, higher 13 SEER requirement for heat pumps; and
- Expanding to 24 (up from 17) eastern and central North Carolina counties covered by the program.

A few months into the contract, ECU found that, since many of their retailers had moved to installing only heat pumps, it would be advantageous for them to begin a systematic transition to the promotion of ENERGY STAR labeled manufactured homes.

To date, the fourth contract with ECU (ending in December, 2008) has achieved the following results:

- 114 heat pump upgrades installed that equal annual winter energy savings of **\$52,782**; and
- Four pending ENERGY STAR home installations.

August 2007:

- A joint “Upgrade and Save” meeting, with project managers from East Carolina University, Appalachian State University, NC Agricultural & Technical State University and the NC Manufactured Housing Institute, was held at the State Energy Office in Raleigh. The purpose of this meeting was to:
 - Share information and resources about their respective programs with all;
 - Identify the steps necessary to increase ENERGY STAR home saturation; and
 - Build manufacturer and retailer awareness of ENERGY STAR.
- The fourth ECU contract was amended to:
 - Offer a \$500 incentive to manufactured home retailers who sell an ENERGY STAR-labeled manufactured home; and
 - Provide a small number of heat pump-only upgrades (up to \$700 per home) to manufactured home retailers who sell only the heat pump upgrade.

September 2007: As a result of our Upgrade and Save Team meeting in the preceding month, we re-convened at the Shult/Clayton Homes plant in Rockwell, NC to discuss ENERGY STAR with plant officials and to tour the facility. In the afternoon, we visited with management at another

Clayton Homes plant (that is now building only ENERGY STAR homes) in nearby Richfield, NC. The event, which was coordinated by ASU, was attended by project managers from ECU, ASU, NCA&T and the Director of Communication for NCMHI.

November 2007: The Director of Communication for North Carolina Manufactured Housing Institute published a very favorable article about Upgrade and Save in their monthly publication, NCMHI NEWS. Included in the article were photos of our Shult/Clayton Homes plant tour, ENERGY STAR manufactured home information, a map showing counties where the program is available and a contact list for program managers at the three Universities. This NCMHI publication has a circulation of about 1,000 and is provided to manufacturers, retailers, community owners and service/suppliers involved in NC's manufactured housing industry.

13. Why is the program a new and creative approach or method?

The Upgrade and Save program provides a long-term, sustainable solution for energy savings in manufactured homes. Our approach was to identify all of the decision-makers in the manufactured home chain and determine how to address the needs of each, individually. The program was not designed to “throw money” at the problem of high energy bills, but to address it at the factory, the retail level and in the finished home. This program is based on energy savings, education and awareness, market transformation and measured deliverables.

- Energy Savings
 - Heat pumps use less energy than electric resistance furnaces. A typical heat pump has a Coefficient of Performance (COP) of three to four, while a typical electric resistance furnace has a COP of 1.0.
 - Since manufactured homeowners are generally in the low to moderate income category, a high percentage of their income being used for energy costs, then the dollars they save is magnified.
 - Reduced energy bills decrease the need for additional generation from utilities during high peak winter months.
- Education and Awareness
 - Manufacturers will be informed of the value associated with building a more energy efficient manufactured home and recommending heat pumps.
 - Retailers will be visited and provided with heat pump information for their sales staff and potential home buyers.
 - Manufactured homeowners will be given instruction and information on the heat pump and its proper operation.
- Market Transformation
 - Use the heat pump education path to transition manufacturers, retailers and potential home owners toward ENERGY STAR labeled manufactured homes.
 - Explain the economic benefits of ENERGY STAR for:
 - Manufacturers who build a better, more efficient and more desirable home;
 - Retailers who benefit from selling a more efficient home and happy buyers; and
 - Homeowners who benefit from living in a comfortable and efficient home.
- Measured Deliverables
 - A technical analysis of heat pumps versus electric resistance systems will quantify the energy savings generated from a heat pump upgrade.

- Heat pump upgrades will be tracked and reported to determine the actual number of installations.
- Cumulative energy savings associated with heat pump upgrades will be tracked and documented. Once installed, the heat pump will operate for its 15 year (or more) life cycle, thus providing energy savings that continue to grow.
- The environmental impact of this program is noteworthy. Since each heat pump upgrade reduces energy usage by 7,230kWh per home per year, the five-year cumulative emissions reduction associated with not having to generate additional electric generation during the period results in a kWh savings of 8,112,060. This kWh savings results in emissions reductions of:
 - 10,488,894 pounds CO₂;
 - 61,733 pounds of SO₂; and
 - 23,768 pounds of NO_x.
- From an economic impact perspective, this program has:
 - Increased the five year cumulative cash flow of the 442 homeowner participants by \$721,446 or an average of \$693 per home per year; and
 - Stimulated the economies of the 62 counties in which the program is now offered and where the participants live.

14. What were the program’s start-up costs? (Provide details about specific purchases for this program, staffing needs and other financial expenditures, as well as existing materials, technology and staff already in place.)

Since the Residential Program Manager is on a fixed annual salary and his travel was during normal working hours in a state-owned vehicle, no measurable start-up costs are applicable. All other expenses are covered in Question 15.

15. What are the program’s annual operational costs?

The Heat Pumps in Manufactured Homes (Upgrade and Save) Program covers a five year (2003-2007) period involving seven individual contracts (three of which are currently in effect) with four separate contractors. Because of this, I have provided a table below that combines the expenses by year, program delivery expenses, heat pump upgrade expenses and the accumulated expenses for the five year period for all of the contracts.

Table A
Cumulative Five Year Expenses:
Heat Pumps in Manufactured Homes (Upgrade and Save) Program

Expenses(Year)	Program Delivery	Upgrade Expenses	Total Expenses	Cumulative Expenses
Year1 (2003)	47,481	6,276	53,757	53,757
Year2 (2004)	114,339	64,311	178,650	232,407
Year3 (2005)	99,500	87,173	186,673	419,080
Year4 (2006)	67,989	54,804	122,793	541,873
Year5 (2007)	113,320	26,127	139,357	681,230
Cumulative Totals	442,539	238,691	681,230	

16. How is the program funded?

The State Energy Office's funding portion is from the U.S. Department of Energy's petroleum violation escrow funds. The DOE was given this money, collected from the federal government in court settlements from major petroleum suppliers for overcharging customers, to allocate to energy efficiency and conservation efforts in the United States. This funding was scheduled to end in 2008-2009.

Additional funding is provided by matching dollars from the contractors who administer the program in their respective regions of North Carolina. Contractor matching funds account for about 20% of the total project expenses.

17. Did this program require the passage of legislation, executive order or regulations? If YES, please indicate the citation number.

No legislation, executive order or regulations were required to initiate this program.

18. What equipment, technology and software are used to operate and administer this program?

Since the affiliated contractors already have computers equipped with basic office programs such as Microsoft Office Suites, no additional equipment, technology or software is required. East Carolina University, who performed the heat pump energy saving analysis, used its own equipment and related software to perform the task.

19. To the best of your knowledge, did this program originate in your state? If YES, please indicate the innovator's name, present address, telephone number and e-mail address.

Yes, to the best of my knowledge, this program originated in our state. Our pilot program began in June of 2003 when we contracted with Mr. Andy Yakim at Greenville Utilities Commission, 201 Martin Luther King, Jr., Greenville, NC 27835. His phone number is (252) 551-1525 and the e-mail address for GUC is <http://www.ci.greenville.nc.us>.

20. Are you aware of similar programs in other states? If YES, which ones and how does this program differ?

The idea of offering incentives for energy efficiency is not new; however, the Heat Pumps in Manufactured Homes (Upgrade and Save) Program utilizes concepts, methodologies and strategies that are unique. In searching for ways to help low to moderate income customers save energy dollars, we found that involving everyone in the manufactured home sales chain (manufacturers, retailers, and customers) was necessary to effectively address the problem. Key components include:

- Educating all persons in the manufactured home sales chain on the value of heat pumps and energy efficiency (i.e., ENERGY STAR);
- Building strong business relationships through personal site visits to retailers and manufacturers;
- Providing financial assistance to retailers to assist low to moderate income customers;
- Conducting site visits to upgrade installations for verification of the installation and education of the home owner on heat pump operation;
- Analytical verification of heat pump savings by engineers at East Carolina University;
- Involving the industry association, NC Manufactured Housing Institute, in the program;

- Systematic tracking of each installation and saving associated with the upgrade;
- Market transformation from heat pump upgrades to whole-house ENERGY STAR efficiency levels; and
- Using the East Carolina University program template to replicate the program at two other Universities (Appalachian State University and North Carolina Agricultural and Technical State University) in two new regions of the state comprising 39 counties.

The South Carolina Energy Office has inquired about the benefits of the program.

21. Has the program been fully implemented? If NO, what actions remain to be taken?

It has been fully implemented in 62 of North Carolina’s 100 counties. Our goal is to have the program available throughout the entire State. We expect to accomplish this by contracting with SEO partners (such as ECU, ASU, NC A&T, etc.) who will continue working effectively with manufacturers, retailers and potential manufactured home buyers to accomplish this statewide energy efficiency mission.

22. Briefly evaluate (pro and con) the program’s effectiveness in addressing the defined problem[s] or issue[s]. Provide tangible examples.

The Heat Pumps in Manufactured Homes (Upgrade and Save) Program has effectively addressed the problem of high energy bills in electric resistance heated manufactured homes. Through 2007, a total of 442 heat pump upgrades were installed with average annual energy savings of \$643 per home. Cumulative energy savings for the homes over a five year period equals **\$721,446**. Table B (below) provides more detail on the five year energy savings.

Table B
Cumulative Five Year Savings:
Heat Pumps in Manufactured Homes (Upgrade and Save) Program

YEAR	2003	2004	2005	2006	2007	Cumulative Totals
HP Upgrades/Yr.	17	131	64	91	139	442
Year1 (2003)	10,931					\$10,931
Year2 (2004)	10,931	84,233				\$106,095
Year3 (2005)	10,931	84,233	41,152			\$242,411
Year4 (2006)	10,931	84,233	41,152	58,513		\$437,240
Year5 (2007)	10,931	84,233	41,152	58,513	89,377	\$721,446
Total Savings	\$54,655	\$336,932	\$123,456	\$117,026	\$89,377	

Savings Table Assumptions are as follows:

1. Average savings per winter month is \$643 per manufactured home heat pump upgrade. (e.g., 17 X \$643 = \$10,931); and
2. Annual savings per upgrade begins the year of the upgrade & continues each year thereafter. (e.g., \$10,931 X 5 = \$54,655).

A five year cost-benefit analysis (see Table C below), of the upgrades installed to date, shows a net savings of \$40,216 in year five (2007). Since the upgrade expenses for the 442 upgrades to date are a one-time cost (see Table A in Question 15) and the energy savings recur each following year; **the net savings at 10 years and at 15 years is \$1,461,246 and \$2,882,276, respectively.**

Table C
Cumulative Cost-Benefit Analysis:
Heat Pumps in Manufactured Homes (Upgrade and Save) Program

Savings Period (Calendar Years)	Upgrade Expenses	Cumulative Upgrade Savings	Net Benefit/Savings	Cumulative Net Benefit/Savings
Years 1-5 (2003-2007)	681,230	721,446	40,216	40,216
Years 6-10 (2008-2012)	0	1,421,030 (see Assumption 1)	1,421,030	1,461,246
Years 11-15 (2013-2017)	0	1,421,030	1,421,030	2,882,276
Cumulative Totals	\$681,230	\$3,563,506	\$2,882,276	

Cost-Benefit Table Assumptions are as follows:

1. Since all expenses for years 1-5 are complete, the cumulative net annual savings for years 1-15 totals \$2,882,276 (e.g., \$40,216 + \$1,421,030 + \$1,421,030 = \$2,882,276); and
2. The average operational life of a heat pump is assumed to be at least 15 years.

Customer feedback from the Upgrade and Save home owner participants has been very positive. The following are samples of their program-related comments.

- The Willis family of Merry Hill, NC, provided the following statement: "We are very satisfied with our heat pump. We have had an electric furnace and a gas pack in our previous homes, but the heat pump is by far the least expensive to operate."
- The Mills family of Rocky Mount, NC, stated that: "We have been heating and cooling our 2300 square foot home for around \$100 a month by sticking with the recommended settings provided by the Upgrade & Save administrator. The temperature inside our home is always comfortable. We were skeptical about the heat pump at first, but it has turned out to be great!"

As evidenced by the following comments, the manufactured home retailer participants were also very receptive to and pleased with the program.

- A manufactured home retailer in Goldsboro, NC sent the following comment to East Carolina University: "I wanted to take a minute to tell you that the Upgrade & Save program is a great way for us to offer a more energy efficient home to our customers and still be price competitive. When the program started we then made every HUD home we sell standard with a 13 seer heat pump. Our pricing remained the same as it always have been when everything in the manufactured home industry was done as economical as possible. Now our customers have a very energy efficient home for the same cost. Thanks again for all your help."
- A Morehead City, NC manufactured home retailer provided the following feedback about the program: "We love the program because it has enabled us to offer heat pumps at a lower cost. We save the customer money initially and in the long term through their electric bills. Our customers are happier which creates future referrals. It is a win win situation for all involved."

23. How has the program grown and/or changed since its inception?

The Heat Pumps in Manufactured Homes (Upgrade and Save) Program began as an effort to reduce energy costs in manufactured homes heated with electric resistance heating systems and it has grown substantially as follows:

- Our vision was to save energy for owners of manufactured homes and now 442 of them are saving an average of \$643 per year for a cumulative five year savings of \$721,446;
- We wanted the Upgrade and Save program to be available throughout North Carolina and it has now grown (in less than five years) from one county in the east to 62 counties statewide; and
- We envisioned heat pumps as the standard heating system for all manufactured homes in our State and now most of the retailers have moved toward heat pumps totally and/or are regularly offering heat pumps as an upgrade.

The Program's emphasis has changed from a heating system perspective only to a whole-house energy efficiency focus. For example:

- The heat pump education and awareness initiative has transitioned into a real desire for even more efficient ENERGY STAR labeled manufactured homes;
- Manufacturers are now beginning to build ENERGY STAR, retailers are beginning to promote them and customers are beginning to buy them;
- The new emphasis on ENERGY STAR offer homeowners both an energy efficient heating system and an energy efficient home;
- ENERGY STAR homeowners can save even more by participating in the Duke Energy and Progress Energy 5% Energy Conservation Discount programs that reduce the ENERGY STAR home customer's energy bills by 5% each month for customers in their respective territories;
- A \$1,000 Federal tax credit, available to manufacturers who build ENERGY STAR homes, will receive renewed interest from manufacturers (who ship homes into NC) as demand for these homes rise; and
- Our future emphasis will continue to be on the manufacturers and retailers with a concerted effort to have them build only ENERGY STAR homes.

24. What limitations or obstacles might other states expect to encounter if they attempt to adopt this program?

Other states who attempt to adopt the Upgrade and Save program should consider taking the following steps:

- Identify funding resources that will allow them to provide incentives for manufactured home retailers;
- Establish a working relationships with universities who are currently involved in energy efficiency and desire to offer education/outreach to manufacturers, retailers and potential manufactured home buyers;
- Involve everyone who is a participant in the manufactured home sales chain to:
 - Establish strong business relationship with manufacturers who ship homes into the state;
 - Identify and systematically contact manufactured home retailers who are operating in the state;
 - Build, cultivate and utilize relationships with both the statewide manufactured home industry organizations (ours is the NC Manufactured Housing Institute,

but other states have similar ones) and the (national) Manufactured Housing Institute's Manufactured Housing Research Alliance; and

- Provide program related information to manufacturers, retailers and homeowners on a regular basis
- Consistently track and report results to increase the program's exposure and acceptance; and
- Be patient and persistent because the seeds of a successful program need time to sprout, take root and grow to fruition.