DOE/R3/40450--T1

**ENERGY EFFICIENT LOW-INCOME HOUSING DEMONSTRATION
WITH
HOUSTON HABITAT FOR HUMANITY**

GRANT NUMBER: DE-FG43-95R340450

**Final Status Report for the Grant
Period 10/01/95 to 09/30/97**

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Report Date: Sept 30, 1997

**PREPARED FOR THE
US Department of Energy
Region 3 Support Office
Philadelphia, PA**

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EXECUTIVE SUMMARY

ENERGY EFFICIENT LOW-INCOME HOUSING DEMONSTRATION HOUSTON HABITAT FOR HUMANITY

Grant Number: DE-FG-95R340450

Using USDOE grant funds, the Alliance to Save Energy developed and managed an award-winning low-income housing demonstration in cooperation with Houston Habitat for Humanity at the 1996 and 1997 annual NAHB Builders Show in Houston, Texas. Using a unique group of over 30 national, state and local partners, the energy design of Houston Habitat houses was permanently upgraded to the DOE/EPA ENERGY STAR HOMES Program threshold.

Using the ENERGY STAR HOMES Program criteria, a design team increased the level of efficiency approximately 30 percent over the 1992 Model Energy Code. This design added approximately \$1,400 in energy upgrades with an estimated payback of less than 8 years. The over 30 public-private partners successfully demonstrated energy and resource efficient housing techniques to the 65,000 NAHB home show attendees and the over 3,000 Habitat affiliates. This project resulted in the Houston Habitat affiliate becoming the nation's first low-income ENERGY STAR HOMES Program home builder. By the year 2000, Houston Habitat anticipates building over 500 homes to this new level of efficiency as well as continue to set an example for other Habitat affiliates nationwide to follow.

The demonstration was highly publicized nationwide through Houston Lighting and Power's commercial television program, *Our House*. It was shown in 15 major television markets in 1996 and 1997 and seen by an estimated 5 million viewers both years. It was featured in the NAHB convention newspaper, *Nations Building News*, and attracted local television coverage from six major TV channels in the Houston area in 1997. In addition, the 1996 demonstration project was chosen by the US Housing and Urban Development as one of 62 national Housing Innovation Award winners.

Pictured in front of the Houston Habitat for Humanity Energy-Affordable Home are Dan Dippon of Houston Lighting & Power and the new Habitat homeowner, Jacquelin Small, with her two children.

The
ALLIANCE
To Save Energy

**The Light
company**
Houston Lighting & Power

Other promotional photographs are available. For more information, please contact Cindy Conte, Houston Lighting & Power Public Information Manager, at (713) 229-7702 or Alliance to Save Energy Director of Communications Mary Ann Goulay at (202) 857-0666.

PROJECT SUMMARY

ENERGY EFFICIENT LOW-INCOME HOUSING DEMONSTRATION HOUSTON HABITAT FOR HUMANITY

Grant Number: DE-FG-95R340450

Description

Using DOE grant funds, the Alliance to Save Energy developed and managed an award-winning low-income housing demonstration in cooperation with Houston Habitat for Humanity at the 1996 and 1997 annual NAHB Builders Show in Houston, Texas. Using a unique group of over 30 national, state and local partners, the energy design of Houston Habitat houses was permanently upgraded to the ENERGY STAR HOMES Program threshold.

Project Partners

National and State Partners -- Alliance to Save Energy, Florida Solar Energy Center, Habitat for Humanity International, National Association of Home Builders Energy Committee, Oak Ridge National Laboratory, Texas A&M University, Texas State Energy Conservation Office, Schuller International, US Department of Energy, and the US Environmental Protection Agency ENERGY STAR HOMES Program.

Local Partners -- Emerald Homes, Greater Houston Builders Association, Houston AIA Committee, and Houston Lighting & Power Company.

Services, Materials, and Appliance Partners -- Browning Ferris Industries, Carrier Corporation, Frigidaire, Henderson Electric, Inc., Home Depot, Honeywell, L.D. Brinkman/Congoleum, Marek Brothers, Quality Cabinets, State Industries, and Whirlpool Corporation.

Project Approach

Meeting ENERGY STAR HOMES Program criteria, the partner design team increased the level of efficiency approximately 30 percent over the 1992 Model Energy Code. This innovative design using commercially available materials added approximately \$1,400 in cost-effective energy upgrades with an estimated payback of less than 8 years. The 30 public-private partners successfully demonstrated energy and resource efficient housing techniques to the 65,000 NAHB home show attendees and the over 3,000 Habitat affiliates. This project resulted in the Houston Habitat affiliate becoming the nation's first low-income ENERGY STAR HOMES Program home builder. By the year 2000, Houston Habitat anticipates building over 500 homes to this new level of efficiency as well as set an example for other Habitat affiliates nationwide to follow. The 1997 demonstration house utilized an all-women volunteer builders team to construct a 3 bedroom home in Houston Habitat's Woodglen Subdivision (See Appendix A for 1996 & 1997 Brochures). Energy consumption was remotely metered by Texas A&M (See Appendix F).

Quarterly Progress Reports

See Attached iprogress report which more fully describes the successful approach undertaken during the final quarter of this grant (Appendix B).

Project Design

Simple, cost-effective features of the 1996 and 1997 Energy-Efficient Affordable Home includes six major features to whole-house design:

- 1) Thermal Efficiency,
- 2) Equipment,
- 3) Building Ventilation and Air Infiltration Control,
- 4) Solar Design and Orientation,
- 5) Lighting Design, and
- 6) Resource Efficiency (see attached project brochures for complete description).

See Appendix A for detailed description of design features.

Project Publicity

Television -- The demonstration was highly publicized nationwide through Houston Lighting and Power's commercial television program, *Our House* (copies of shows included in transmittal). This program was shown in 15 major television markets in 1996 and 1997 and seen by an estimated 5 million viewers both years (see Appendix C for list of TV markets). The 1997 demonstration house attracted local television coverage from six major TV channels in the Houston area in 1997. Copies of the videos were mailed to the 200 largest Habitat affiliates in 1996 and to over 50 affiliates and others in 1997.

Print Media -- The demonstration was featured in the NAHB convention newspaper, *Nations Building News* and featured in numerous trade publication articles. Project descriptions were printed and handed out at the 1996 & 1997 NAHB Builders Show at the Habitat for Humanity International display booth (see appendices).

Habitat 20th Anniversary Celebration -- Materials were displayed by the Alliance to Save Energy at the Habitat for Humanity 20th Anniversary Celebration in Atlanta, GA in Sep 1997 where over 2,000 attendees from around the globe participated in 3 days of informational workshops, displays, and speeches.

National Award

The 1996 demonstration project was chosen by the US Housing and Urban Development as one of 62 national Housing Innovation Award winners. The HUD program recognizes projects that make significant contributions to expanding affordable housing opportunities through innovative technologies and developmental techniques (see award letter in Appendix D).

APPENDICES

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APPENDIX A

1) 1996 Demonstration Project Booklet

2) 1997 Demonstration Project Pamphlet

**THE
ENERGY
AFFORDABLE
HOME**

Houston Habitat for Humanity

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Printed on recycled paper

HOUSTON HABITAT FOR HUMANITY'S ENERGY-AFFORDABLE HOME

Cost-efficient, low-income affordable housing

The Houston Habitat for Humanity Energy-Affordable Home is a unique education and demonstration project conducted in conjunction with the 1996 National Association of Home Builders convention and home show in Houston. This energy-efficient, affordable home showcases simple, lower-cost, readily available, energy and environmentally sound materials and technologies for builders of low-income housing and for the Habitat for Humanity affiliates.

A close partnership exists between professional home builders and local Habitat for Humanity affiliates nationwide. This demonstration serves to strengthen that unique relationship by emphasizing the impact of energy-efficient design in housing for low-income homeowners and by providing a model partnership for duplication in communities all across America. It also serves as a catalyst for change for all local Habitat for Humanity affiliates to provide more energy-conserving and environmentally sound housing.

Pictured at the Houston Energy-Affordable Home are Dan Dippon, HL&P, and the new Habitat homeowner, Jacquelin Small with her two children.

GOALS: EMPHASIZE HOUSING AFFORDABILITY THROUGH ENERGY-EFFICIENCY

Goal

***Increase housing affordability by
reducing energy use***

The primary goal of this project is to increase housing affordability for low-income Habitat for Humanity homeowners by significantly reducing energy costs through sensible energy design and more efficient cooling/heating equipment, appliances, and water heaters. Utility expenses are the second largest monthly cost of home ownership after the mortgage payment and can be significantly reduced by low-cost investments in a comprehensive array of carefully selected components.

Goal

***Demonstrate sensible, easy to install,
cost-efficient energy and environmental
options***

A secondary goal is to demonstrate the simple, low-cost options employed in this house to Habitat affiliates and professional builders nationwide so they may utilize the same approaches. Saving energy requires careful selection of many options as well as quality housing construction — which presents special challenges for organizations utilizing volunteer labor. Accordingly, the techniques and products used must be simple and easy to install as well as cost-efficient.

Goal

***Encourage volunteer-based organizations to
adopt energy and environmental choices***

This project also serves as an exemplary model for organizations, volunteer-based groups, and local builders desiring to enhance housing affordability through energy conscious design and construction practices utilizing a team approach of volunteer organizations and individuals.

BUILDING AN AFFORDABLE, ENERGY-EFFICIENT AND ENVIRONMENTALLY SOUND HOME

Lowering the cost of home ownership through reduced energy use while maintaining comfort and security is readily obtainable through more efficient design and construction practices. Department of Housing and Urban Development surveys indicate that low-income homeowners use a disproportionately high percentage of their income for utilities, as much as 20 to 30 percent compared to 10 to 15 percent for middle-income families.

The Habitat Energy-Affordable Home [Model 3c Energy Plan, 1,104 sq. ft., 3 bedroom] in Houston's Wood Glen subdivision was built to significantly reduce energy consumption while minimizing first-cost increases. Because the house uses proven, easy-to-install, cost-efficient technologies which are readily available in every community, it is easily replicable by builders and nonprofit groups, proving that energy efficient homes can be built at an affordable price.

The energy features of the Energy-Affordable Home meet or exceed the energy efficiency standards for Houston Lighting & Power's (HL&P) Good Cents Home Program and the U.S. Environmental Protection Agency's (EPA) new ENERGY STAR Homes Program.

Energy savings of 30 percent predicted

The Florida Solar Energy Center's (FSEC) and the U.S. Department of Energy's (DOE) analysis of the Houston Energy-Affordable Home predicts a 30-percent reduction in cooling, heating, and water heating costs over existing homes in Houston Habitat's Wood Glen subdivision. Recent monitoring of 10 Habitat homes in south Florida by FSEC indicated almost 50 percent of energy consumption was for cooling. Based on this analysis and the requirements of HL&P's Good Cents Home Program and EPA's ENERGY STAR Homes Program, the Energy-Affordable Home design team recommended increased insulation, better ventilation, solar shading, and more efficient equipment and appliances.

Breakdown of energy consumption by end-use at the ten Habitat control homes in Florida City, from July - November 1994 (Source: FSEC).

BUILDING AN AFFORDABLE, ENERGY-EFFICIENT AND ENVIRONMENTALLY SOUND HOME (CONT.)

Minimal upfront investment qualifies more low-income families for housing

Historical averages of monthly utility bills range from \$90 to \$110 for Habitat homeowners in Houston's extremely humid, hot climate. By lowering the cost of utilities an average of \$25 to \$35 monthly, Habitat affiliates are able to qualify more homeowners for their program with a minimum initial investment. The Houston Habitat Energy-Affordable Home energy package adds roughly \$1,800 to the first costs, including rebates, yielding a positive monthly cash benefit from the beginning to the homeowners with an estimated average simple payback of 8 years. Lowering utility bills by an average of 30 percent will lower the median Habitat family income qualifying requirements from \$1,250 a month to \$1,100 a month. Accordingly, Houston Habitat will incorporate these cost-efficient energy features in all future homes and enthusiastically recommends that other affiliates consider energy-efficient upgrades to lower the total cost of housing for their clients.

Energy savings to be monitored and analyzed

The Energy-Affordable Home will be monitored for one year using equipment and techniques pioneered at Texas A&M's Energy System Laboratory and the Texas State Energy Conservation Office. Monthly analyses and a report after the first year of occupancy will help determine the cost-effectiveness of the energy features. This same information will be used to provide timely feedback to all the project partners and more importantly to the owner-occupants who control the operating conditions.

Homeowner education

A key component to the persistence of savings is homeowner training and an understanding of the impact of home operation on monthly utility expenses. Studies by the Alliance to Save Energy of low-income weatherization recipients indicate that savings can increase by as much as 50 percent and persist over time with homeowner education. Adding an energy education component to the existing homeowner training by Habitat strengthens and enhances the long-term energy savings for homeowners in Houston's Wood Glen subdivision.

THE ENERGY-AFFORDABLE HOME:

ENERGY AND ENVIRONMENTAL FEATURES

Energy-Efficient HVAC System — 12.0 SEER air conditioner, programmable digital thermostat, properly sized for heating/cooling loads, high-efficiency (80% AFUE) gas furnace with electronic ignition, upgraded duct insulation, and mastic joint sealing.

Improved Insulation — R-30 ceiling and R-16 wall insulation, optimized for local climate conditions, with vapor barriers. Exterior rigid foam sheathing with taped joints. Insulated exterior doors with weather stripping and airtight thresholds. Insulated, weather-stripped attic access ladder.

Energy-Efficient Utility Room — Furnace unit located in fully ventilated, non-air-conditioned, insulated space within the utility room and uses outside air for combustion. Weather-stripped furnace room door.

Efficient Water Heating — High-efficiency water heater located in non-conditioned attic space. Includes electronic ignition, insulated inlet-outlet supply lines with convective heat traps, temperature setting of 120 to 130 degrees, and properly sized tank.

Energy-Efficient Appliances — Refrigerator, washer, dryer, and water heater meet or exceed the minimum national appliance energy standards.

Increased Ventilation — Living and sleeping areas use natural cross ventilation through operable windows. Bedrooms and major living areas have reversible ceiling fans for improved air circulation in summer and winter. Continuous ridge and soffit vents for maximum non-mechanical cooling of attic space. Building is blower-door pressure tested. Switch-controlled exhaust air fans located in bath and cooking areas for humidity and air quality control. All exterior wall and ceiling penetrations and sole plates caulked and sealed.

Enhanced Solar Shading — Covered front porch with full shading of front door and windows. Two-foot roof overhangs and solar window screens installed for significantly reduced solar gain. Long axis of house oriented east-west to minimize solar gain. White vinyl siding and light-colored roof shingles.

Efficient Lighting — Efficient fluorescent lights in kitchen. Exterior security lighting uses photocell controls and lower-wattage bulbs.

Environmental Improvements — Low VOC interior paints and floor coverings. Water conservation through low-flow shower head, faucets, and no-lead fixtures.

PARTNERSHIP: KEY TO SUCCESS

This unique project by the Houston Habitat for Humanity and its partners goes well beyond affordable, energy-conscious design by clearly demonstrating the advantages of a team approach to energy-efficient and environmentally sound construction. This project's structure is readily replicated at the local level without the assistance of national organizations required to conduct this demonstration to a national audience.

The Houston Habitat for Humanity Energy-Affordable Home partnership members include:

- Energy conscious home builders;
- Energy and environmental design professionals;
- Utility company energy-efficiency experts;
- Manufacturers and suppliers of efficient equipment, materials, and appliances;
- Habitat for Humanity volunteers dedicated to energy-efficient construction;
- National energy and environmental organizations (optional for local projects); and
- Federal agency and national laboratory residential technical experts.

The Energy-Affordable Home partnership consists of representatives from several local and national organizations, both public and private, that provided the necessary resources and skills for a well-rounded perspective on the proposed design and function.

HOUSTON HABITAT FOR HUMANITY

ENERGY-AFFORDABLE HOME PARTNERS

Local Partners

Emerald Homes
Greater Houston Builders Association
Houston AIA Environment Committee
Houston Habitat for Humanity
Houston Lighting & Power Company
Rasbach Designs/Provident Homes

National and State Partners

Alliance to Save Energy
Florida Solar Energy Center
Habitat for Humanity International
National Association of Home Builders Standing Committee on Energy
Oak Ridge National Laboratory
Texas A&M Energy Systems Laboratory
Texas State Energy Conservation Office
U.S. Department of Energy
U.S. Environmental Protection Agency

Services, Materials, and Appliance Partners

Browning Ferris Industries
Carrier Corporation
Frigidaire
C.W. Henderson Electric Inc.
Home Depot
Honeywell Inc.
L.D. Brinkman/Congoleum
Marek Brothers
Quality Cabinets
Schuller International, Inc.
State Industries/Ferguson Enterprises, Inc.
Whirlpool Corporation

Founding Sponsors

Houston Lighting & Power Company
U.S. Department of Energy
U.S. Environmental Protection Agency

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Special Partner Recognition

Special thanks and recognition are due a number of individuals and organizations without whose assistance this project would not be possible. Invaluable design assistance was provided by Janet McIlvaine, Florida Solar Energy Center. Duane Bradshaw and Steven Jovicich, local Houston architects. Roger Rasbach, local housing designer. Dan Dippon and Stacy Davis of HL&P, and Tom Rooney, EPA. Construction labor was provided by HL&P employee volunteers and by Brian Binash of Emerald Homes when the project seemed hopelessly behind schedule due to adverse local weather conditions.

George James and Mike Myers of DOE's Office of Building Technologies and Sam Rashkin of EPA's ENERGY STAR Homes Program provided the initial financial support that enabled this project to become a demonstration for our nation's professional home builders and the 1,200 Habitat for Humanity affiliates. Ed Vineyard of Oak Ridge National Laboratory was instrumental in obtaining energy-efficient home appliances for the new owner. Long-term savings and design recommendations will be monitored by Jim Eggebrecht of Texas A&M's Energy Systems Laboratory, thanks to Tobin Harvey, Texas State Energy Conservation Office Director.

Initial support from Tom Jones, Habitat for Humanity International's D.C. office, Lou Divone, DOE headquarters, Ron Burton, NAHB's Standing Committee on Energy, and Shirley Wiseman Lach, Alliance Board Member, helped jump start this project. Special recognition is due Ralph McNeir, Houston Habitat's construction supervisor who provided the practical field experience to turn design ideas into reality and who exhibits a rare willingness to change construction practices. Project promotion and publication design was aptly provided by Jay Wattenberg and Mary Ann Gourlay of the Alliance to Save Energy and Cindy Conte of Houston Lighting & Power. HL&P's strong corporate commitment to this project was unwavering. Additionally, they are helping magnify those efforts by sponsoring a special 30-minute documentary on the *Our House* television program produced by Black Dog Productions.

Overall project coordination was provided by Malcolm Verdict, Alliance to Save Energy, who is deeply appreciative to the many volunteers, contributors, and suppliers who are frequently asked to provide support for such projects. Finally, this project and its positive economic impact on the lives of all Habitat homeowners would not have been possible without the cooperation, vision, faith in the design team, and personal leadership of Mike Shirl, Executive Director of Houston Habitat for Humanity.

The Affordable, Energy-Efficient, Award-Winning House...

that enterprising women built

**Presented by
Houston Habitat for Humanity**

Energy-Efficient Homes Aid Houston's Low-Income Families

Enterprising women volunteers, an often untapped source of labor, built the Houston Habitat for Humanity 1997 **Energy-Efficient Affordable Home**, which significantly reduces energy use while controlling first-costs. The labor team was led by National Association of Home Builders' 1989 President Shirley Wiseman Lach and Habitat for Humanity's Linda Fuller. The house incorporates proven, easy-to-install, cost- and energy-efficient technologies which are recommended by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). Houston Habitat's approach is easily duplicated by builders nationwide. The affiliate was recently recognized by the U.S. Department of Housing and Urban Development for its exemplary efforts to increase housing affordability.

Energy savings of 30 percent

The award-winning 1997 **Houston Energy-Efficient Affordable Home** design offers a 30 percent improvement in cooling, heating, and water heating costs over existing homes in the Wood Glen subdivision built to the local energy code, according to estimates by the Florida Solar Energy Center.

Houston Habitat now incorporates cost-efficient energy features in all their homes and the Alliance to Save Energy recommends that other Habitat affiliates and builders install similar energy-efficient upgrades to lower the total cost of housing.

Minimal up-front investment qualifies more families

The Houston Habitat energy package adds roughly \$1,800 (a four percent increase) to the \$40,000 base price of a three bedroom, 1,100 square foot house. "Decreasing utility bills by an estimated 30 percent lowers the median Habitat family income qualifying requirements \$150 per month from \$1,250 to \$1,100," according to Mike Shirl, executive director of Houston Habitat.

Historically, utility bills in the Wood Glen subdivision range from \$90 to \$110 monthly. Habitat's new design provides utility savings of \$25 to \$35 monthly — while the corresponding mortgage payment increases by only \$8 per month — significantly qualifying more low-income families in Houston. (Note: Actual bills are dependent on owner operation of the house, equipment, and local weather conditions.)

Homeowner education is key

Homeowner training and a clear understanding of the impact of home operation on utility expenses is key to the persistence of savings. Studies of low-income weatherization recipients by the Alliance to Save Energy indicate that homeowner education can increase savings by as much as 50 percent and that savings will persist over time. Houston Habitat is providing energy education and operating guides from Houston Lighting and Power (HL&P) for new homeowners in its Wood Glen subdivision to enhance long-term energy savings.

Energy features recognized nationwide

Energy features of the 1997 Energy-Efficient Affordable Home meet or exceed the energy efficiency requirements for HL&P's Affordable Home Program and the jointly promoted EPA and DOE ENERGY STAR Homes Program. The insulation package, which includes ComfortTherm® encapsulated insulation, was calculated using Schuller International's Performance Home proprietary software.

Houston Habitat Partners Set Exemplary Project Goals

Houston Habitat for Humanity and its local board of directors and volunteers provide simple, decent housing for low-income families who otherwise could not own a home. Houston Habitat and its Affordable Housing Partners adopted the following goals to guide this project and to leverage existing efforts to provide more affordable housing for low-income families:

1.

Increase housing affordability by reducing energy costs

The primary goal of this project is to increase housing affordability for low-income homeowners by reducing energy use. Utility expenses, the second largest monthly cost of home ownership after the mortgage payment, can be significantly reduced with cost-efficient investments in sensible energy design; increased insulation; and more efficient cooling, heating, and water-heating equipment.

2.

Demonstrate sensible, easy-to-install, cost-efficient energy and environmental options

Another goal is to demonstrate the simple, low-cost options employed in this house to Habitat affiliates and professional builders nationwide so they may utilize similar approaches. Saving energy requires careful selection of many options as well as quality housing construction, which presents special challenges for organizations utilizing volunteer labor. Accordingly, the techniques and products used must be simple, easy to install, and cost-efficient.

3.

Encourage volunteer-based organizations to utilize partnerships

Finally, this project utilizes a team approach of volunteer organizations and individuals. It also serves as an exemplary model for organizations, volunteer-based groups, Habitat affiliates, and home builders desiring to enhance housing affordability through energy-conscious design and cost-efficient construction practices.

Key Sponsors of the 1997 Habitat for Humanity Energy-Efficient Affordable Home

The
ALLIANCE
To Save Energy

House Sponsor

HL&P
Houston Lighting & Power

Partnership Approach and All-Women Volunteers Are Key

This project by Houston Habitat for Humanity and its partners goes beyond affordable, energy-efficient design. It demonstrates the advantages of a team approach which is easily replicated nationwide. The Energy-Efficient Affordable Home Partnership consists of representatives from local and national organizations that provided the necessary resources, labor, and skills for a well-rounded perspective on affordability through energy-saving design and resource efficiency.

The 1997 Houston Habitat for Humanity Energy-Efficient Affordable Home Partnership includes:

- All-women volunteer labor force, led by Habitat for Humanity's Linda Fuller and 1989 NAHB President Shirley Wiseman Lach.
- Energy and environmental design professionals.
- Utility company energy efficiency experts.
- Manufacturers and distributors of efficient equipment, insulating materials, and appliances.
- Energy-conscious home builders.
- National energy and environmental organizations.
- Federal agency, state, and national laboratory residential energy design experts.

Project partners provided funding, building materials, volunteers, and equipment to Houston Habitat. Design assistance for the house and project promotion to our nation's home builders and over 1,300 Habitat affiliates was provided by the Alliance to Save Energy, DOE, EPA, Florida Solar Energy Center, Houston Lighting and Power, and the Texas State Energy Office.

Habitat's successful approach to energy- and resource-efficient homeownership will be publicized nationwide in a 30-minute documentary sponsored by Houston Lighting and Power and DOE as part of the award-winning "Our House" television series.

Energy-Efficient Affordable Home Partners

House Sponsor

Schuller Corporation

Local Partners

Greater Houston Builders Association
Houston AIA Environment Committee
Houston Habitat for Humanity
Houston Lighting & Power Company

National and State Partners

Alliance to Save Energy
Florida Solar Energy Center
Habitat for Humanity International
National Association of Home Builders Subcommittee on Energy
Oak Ridge National Laboratory
Texas A&M Energy Systems Laboratory
Texas State Energy Conservation Office
U.S. Department of Energy
U.S. Environmental Protection Agency

Services, Materials, and Appliance Partners

AES Houston-Carrier
C.W. Henderson Electric Inc.
Honeywell Inc.
Schuller International, Inc.
Solarex Screens
Stanley Tools

Promotional Partners

Sunny 99.1 FM
Our House TV Show (Habitat House TV program funded by U.S. DOE and Houston Lighting & Power)

Technical Assistance Partners

U.S. Department of Energy
U.S. Environmental Protection Agency

Simple, Cost-Effective Design Features

The simple, cost-effective features of the 1997 Energy-Efficient Affordable Home include six major components to whole-house design:

1. Thermal Efficiency

Optimum Insulation Levels — R-30 ceiling and R-16 Schuller ComfortTherm® wall insulation, optimized for local climate conditions using manufacturer, utility, and federal agency guidelines. Vapor barriers for moisture control. Rigid foam insulation beneath roof decking for cooler attic operating temperatures for HVAC unit. Exterior wall, rigid-foam sheathing with taped joints. Insulated exterior doors with weather stripping and airtight thresholds. Insulated, weather-stripped attic access.

2. Equipment

Energy-Efficient HVAC System — 12.0 SEER, 1.5 ton Carrier air conditioner properly sized for heating/cooling loads, high-efficiency (80% AFUE) gas furnace with electronic ignition, Honeywell programmable thermostat, upgraded R-6 duct insulation, and mastic duct sealant. Air conditioner and furnace unit located in attic to increase living space and prevent introduction of outside-combustion air into conditioned space. Heating, cooling, and water heating equipment meet or exceed the minimum national appliance energy efficiency standards.

Efficient Water Heating — Properly-sized 40 gallon high-efficiency water heating equipment located in non-conditioned attic space. Includes electronic ignition, insulated inlet-outlet supply lines with convective heat traps, temperature setting of 120 to 130 degrees.

3. Building Ventilation and Air Infiltration Control

Increased Building Ventilation — Living and sleeping areas use natural cross ventilation through operable windows. Bedrooms and major living areas have reversible ceiling fans for improved air circulation in summer and winter. Continuous ridge vent and soffit vents for maximum non-mechanical cooling of attic space. All exterior wall and ceiling penetrations and sole plates caulked and sealed to reduce air leakage in conditioned space.

4. Solar Design & Orientation

Enhanced Solar Shading — Covered porch with full shading of front door and windows. Twenty-four inch roof overhangs, tinted windows with 0.80 shading coefficient and solar window screens installed for significantly reduced solar gain. Long axis of house oriented east-west to minimize solar gain. Light-colored vinyl siding and asphalt roof shingles.

5. Lighting Design

Efficient Interior and Exterior Lighting — Efficient fluorescent lights in kitchen and compact fluorescent exterior security light with automatic photocell on-off controls.

6. Resource Efficiency

Environmental and Water Conservation Improvements — Low VOC interior paints and tile floor coverings. Water conserving low-flow shower head, faucets, and no-lead plumbing fixtures.

Habitat for Humanity's Linda Fuller leads women volunteers in Houston.

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1000 Independence Ave., S.W.
Washington, D.C. 20585
202-586-9167

Lisa Bloomfield-Resch
U.S. Environmental Protection Agency
501 3rd Street, N.W., 4th Floor
Washington, D.C. 20001
202-233-9790

Utility Representative

Dan Dippon
Houston Lighting & Power Company
P.O. Box 1700
Houston, Texas 77251
713-207-3544

Monitoring and Analysis Representatives

Karen Raven, Deputy Director
Texas State Energy Conservation Office
P.O. Box 13047
Austin, Texas 78711
512-463-1931

Jeff Haberl
Texas A&M University
Department of Mechanical Engineering
Energy Systems Laboratory
College Station, TX 77843-3123
409-845-6507

Tarek Bou Sada
Texas A&M University
Department of Mechanical Engineering
Energy Systems Laboratory
College Station, TX 77843-3123
409-845-9213

Alliance to Save Energy
1200 18th Street, N.W., Suite 900
Washington, D.C. 20036

phone (202) 857-0666 • fax (202) 331-9588
e-mail: info@ase.org • <http://www.ase.org/>

Visit the Energy-Affordable Home

— Habitat for Humanity Showcases Energy Efficiency —

The Partnership

The Alliance to Save Energy announces an affordable housing partnership with the Houston affiliate of Habitat for Humanity featuring an energy- and resource-efficient home for display to attendees of the 1996 National Association of Home Builders (NAHB) annual convention in Houston.

The Partners

Local partners include: Emerald Homes, Greater Houston Builders Association, Houston AIA-Environment Committee, Houston Habitat for Humanity, and Houston Lighting and Power Company. National and state partners include: The Alliance to Save Energy, Florida Solar Energy Center, Habitat for Humanity International, NAHB Standing Committee on Energy, Texas State Energy Conservation Office, U.S. Department of Energy and Oak Ridge National Laboratory, and the U.S. Environmental Protection Agency. Product and appliance contributors include: Browning-Ferris Industries, Carrier Corporation, Frigidaire, Henderson Electric, Home Depot, Honeywell Inc., L.D. Brinkman, Marek Brothers, Morrison Supply, Quality Cabinets, Schuller International, State Industries, and Whirlpool Corporation.

The Goals

The goals of this project are threefold. First, increase home affordability for low-income Habitat homeowners by significantly reducing energy costs through improved design, more efficient cooling/heating equipment, and energy-efficient appliances. Second, demonstrate sensible, easy to install, cost-effective options in the Houston Habitat Energy-Affordable Home to Habitat affiliates and builders nationwide so they may utilize the same approaches. Third, encourage volunteer-based organizations to adopt energy and environmental choices.

The Long-Term Benefits

Houston Habitat for Humanity Executive Director Mike Shirl announced that all future homes constructed by his organization will incorporate improved window shading and orientation, energy conserving duct design, water conserving fixtures, increased ceiling and wall insulation, high efficiency heating and cooling equipment, natural ventilation, and energy efficient lighting. This home meets the energy requirements for HL&P's Good Cents Home Program and EPA's Residential Energy Star Homes Program, and exceeds the CABO Model Energy Code by 30 percent.

The Event

Visit the Energy-Affordable Home by taking the Inner City Bus Tour, January 26-28, 1996 (Friday, Saturday and Sunday). Tickets can be obtained at the Greater Houston Builders Association booth at the Astro Hall entrance. Check out the Habitat booth in the Astro Hall exhibit area to learn more about this home. See reverse side for home features and location.

For More Information

Mike Shirl
Houston Habitat for Humanity
Booth at Astro Hall entrance
(713) 521-2816

Barbara Locke
Greater Houston Builders Assn.
Booth at Astro Hall entrance
(713) 776-1445

Dan Dippon
Houston Lighting and
Power Company
(713) 207-3544

Malcolm Verdict
Alliance to Save Energy
(202) 857-0666

APPENDIX B

TECHNICAL REPORT FOR FINAL HOUSE DESIGN

Houston Habitat for Humanity

The Energy-Efficient Affordable Home

Plans and Specifications

**Wood Glen Subdivision
Houston, Texas**

**Rev. Mike Shirl
Executive Director
713-521-0251**

January 1996

Proposed Habitat Home Sites

WOOD GLEN SECTION 3

PROPOSED MIX

Phase	I	II
2BR		3
3BR		35
4BR		12
Reserved	0	10
Totals	43	60

R3 = Lot reserved for other developers

21.53 Acres

937,848 sq. ft.

7/24/95 lth
7/24/95 lth
6/30/95 lth
6/25/95 kk null

Houston
Habitat for
Humanity

SUMMARY of ENERGY FEATURES

Houston Habitat Energy-Affordable House
(1,100 sq.ft., 3bdrm house, exceeds CABO MEC by approximately 30%)

Building Feature	Base Case/Existing Home	Enhanced Case Features	Cost Increase
INSULATION/SEALING			
-Ceiling Insulation	R-25	R-30	\$150
-Wall Insulation	R-11/13	R-13/16	\$200
-Duct Insulation/Sealing	R-4/tape	R-6/mastic	\$100
-Sealing exterior envelope	yes	yes	n/c
		Total Insulation	\$450
WINDOWS - Type			
	Single Pane	n/c	-0-
- Frame	Aluminum	n/c	-0-
-Shading Coefficient	clear	clear	
-Solar Screens	n/a	installed	\$300
		Total Window Upgrades	\$300
WATER HEATER			
	50 gal., nat. gas	30 gal. nat. gas	-
-Location	Conditioned space	Attic (access ladder)	\$100
-Electronic ignition	n/a	Yes	n/c
-Insulated lines	n/a	Insulate supply & outlet lines	75
		Total Water Heater Upgrade	\$175
HVAC			
	10 SEER, 2 ton	12 SEER, 2 ton	\$400
-Heating System		80% AFUE,elec. ignition	n/c
		Total HVAC	\$400
Other			
-Air Infiltration	Medium	Tight, tape ext. sheathing	\$50
-Ceiling Fans	Living room	add to 3 bedrooms	150
-Thermostat	non-programmable	Digital Programmable	75
-Attic Ventilation	cont. ridge/soffit vents	Cont. ridge & soffit vents	n/c
- Roof pitch		Increase pitch - water heater	200
		Total Other	\$475
		Total Energy Upgrade Costs	\$1,800
		Less Utility Rebate	(330)
		Total Cost Increase	\$1,470

INTERIOR ELEVATIONS (NOT TO SCALE)

PLAN 1/4"=1'-0"

AS-BUILT

ADDRESS:	HABITAT FOR HUMANITY Building Homes in Partnership with God's People in Need P.O. Box 6427 Houston, Texas 77266-0427 713-521-5210	HABITAT HOUSE PLAN #3CR-ENERGY	1/22/96 WJR 1/18/98 WJR 9-8-95 WJR REVISIONS:
			CHECKED BY: PW DRAWN BY: AP, TLH DATE: 7 FEB 93 SHEET A1

Features of an Energy Efficient Affordable Home

An energy efficient home not only saves energy and the environment, but money as well.

ENERGY EFFICIENT HVAC SYSTEM

- 12 SEER Air Conditioner
- High Efficiency Gas Furnace
- Programmable Thermostat
- R-6 Ductwork
- Ductwork Sealed with State-of-the-Art Mastics
- Proper Return Air Sizing
- Furnace and Coil Located Beneath Ceiling Insulation in Sealed and Insulated Closet within Utility Room

SUPERIOR LEVELS OF INSULATION

- R-16 Walls • R-30 Ceiling
- Insulated Exterior Doors

ATTIC VENTILATION SYSTEM

Includes a Continuous Ridge Vent and a Series of Soffit Vents

ENERGY EFFICIENT WINDOWS

Single Pane Clear with Solar Screens

SOLAR CONTROL

- Two Foot Overhangs for Wall Shading
- Site Plan Oriented to Minimize Solar Gain
- Shade Trees Planted on West Side of Home
- Light Color Fiberglass Roof Shingles

INCREASED VENTILATION

Ceiling Fan in Every Bedroom

HIGH EFFICIENCY GAS WATER HEATER

Located Outside Conditioned Space

ENERGY EFFICIENT APPLIANCES

ENERGY EFFICIENT LIGHTING

EXTENSIVE WEATHERIZATION MEASURES

ENVIRONMENTAL IMPROVEMENTS

- Low VOC Interior Paint
- Low-flow Shower Heads
- Low-flow Faucets

Energy Design Specifications: Habitat Plan 3-C Energy

-FINAL DRAFT -

HVAC System

Energy Efficient Air Conditioning System

- Air Conditioning System - SEER of 12.0 (donated by Carrier)
- Proper sizing for thermal loads (sizing to be done by Carrier, target is 2.0 ton unit)
- Programmable thermostat (T813 digital thermostat donated by Honeywell)
- Place a/c pad on east or north side of house for shading when orientation permits

Central Gas Furnace

- AFUE efficiency rating of 80 - 85 % minimum
- Electronic ignition pilot
- Automatic vent damper for furnace exhaust
- Proper sizing (to be determined by Carrier, 65,000 BTU may be too large)

HVAC/HEATING Duct System

- Upgrade from R-4 to R-6 insulation
- Seal all flex to metal joints with mastic and strap
- Caulk and seal all grill outlet boots to drywall
- Ducts must pass "Duct Blaster" test (to be performed by HL&P) for minimum air leakage

House Ventilation

- Ceiling fan with light fixture in each bedroom added, separate wall switches for light and fan
- Bath Fan - Broan (or equivalent) exhaust fan, 80 cfm/maximum @ 2.5 sones
- Kitchen Fan (Broan 40 K Series or equiv.) range hood, min. 100 CFM/maximum @ 4.5 sones
- Automatic vent dampers for bath room, kitchen, and dryer vents, exhausted to outside
- Attic: Continuous ridge and soffit vents to reduce heat gain in attic (?)
- Attic chutes: Baffles to prevent blockage of soffit vents with insulation
- Seal all penetrations and holes from electrical, plumbing, telephone, exhaust fans, etc.
- Conduct "Blower Door" pressurization test (HL&P) for 0.35 air changes/ hour @ 50 pascals

Building Envelope

Insulation

- Attic Insulation - R-30 (fiberglass insulation donated by Schuller International)
- Wall Insulation - R-13 in wall cavity, R-3 rigid foam sheathing, Total R-16
- Exterior sheathing joints taped (UC Industries Bild-R Tape or equiv.) to reduce air & moisture
- Exterior doors insulated and weather-stripped

Solar Control

- Two foot roof overhangs for wall and window shading
- Orient site plan east-west to minimize solar gain
- Orient site plan to maximize natural ventilation and available shading from trees
- Add solar screens to all windows (meets solar screen standards 4001 & 5001)
- Good Cents Level One criteria -single pane, tinted with Shading Coefficient of 0.88, metal with thermal break recommended, & maximum sash air leakage of 0.37 cfm per foot
- Plant shade tree on west side of house to shade window (optional)

Building Envelope (continued)

Energy Efficient HVAC/Water Room in Utility Room

- ***Provide outdoor combustion air from the attic***
- Insulate all perimeter walls with R-13 around water heater & a/c furnace unit
- Install insulated door and weather-strip
- Seal and weather-strip door and install threshold

Attic Access Door

- Weather strip door
- Insulate trap door cover with R-30 rigid foam or batt glued or stapled in place

Other

- Chipped board siding (ABTCO) to minimize waste of natural resources
- White vinyl siding
- Light color fiberglass roof shingles
- Use low VOC interior latex paints such as Benjamin Pristine or Gliden 2000

Plumbing

- Low flow shower heads & sink faucets [2.0 GMP Aerator Conservation Std .-A112.118.1M]
- Insulate exterior walls before installing tub or shower and seal perimeter with caulk
- Low lead faucets
- Low flow toilets recommended or install tank trap

Domestic Water Heating

- 40 gallon tank capacity recommended vs. 50 gallon
- Electronic ignition pilot for gas hot water heater and outside combustion air
- Connective heat trap loops for inlet and outlet pipes or manufacturer heat check valve built-in
- Set water heater temperature at medium setting (120 to 130 degrees)
- Insulate first 12 inches of inlet and outlet pipes with foam pipe insulation
- Pick unit with lowest annual operating cost based on therms/yr. and 1st hr Rating Capacity

Lighting

- Kitchen - Surface mount florescent, 2 bulb T-8 fixture with electronic ballast
- Exterior security - 120 or 60 watt incandescent floods/motion detector & photo cell, hard wired
- Front porch - Incandescent or compact fluorescent (more costly/longer life) hard wired/photo cell
- Bath - Incandescent with occupancy sensor switch recommended (motion sw costs \$12 -\$15)
- Bedroom and living room fan/light fixture combo -- hard wired with separate switch controls

MEMORANDUM

DATE: October 24, 1995

FROM: Janet McIlvaine
Research Associate

TO: Mike Shirl, *Houston Habitat for Humanity*

CC: Dan Dippon, *Houston Light and Power*
Malcolm Verdict, *Alliance to Save Energy*
Mike Myers, George James, *U.S. DOE (EE-421)*
Tom Rooney, Glen Chinnery, *U.S. EPA*
Subrato Chandra, Philip Fairey, Danny Parker, Rob Vieira, *FSEC*
Kim Schaefer, *Design for the Environment*
Steve Bissinett, *Habitat for Humanity International - Florida Office*

RE: Houston Habitat for Humanity House

Congratulations! A star is born, an *Energy Star* that is.

Comparing the design of the Houston Habitat energy house with a reference house modeled using guidelines laid out in the Home Energy Rating System Guidelines, the Habitat house was found to save in excess of the required 30% of heating, air conditioning, and water heating energy. The features of the Houston house and the reference house appear in Table 1. The following findings are taken from output generated by DOE2.1E, a software program that simulates the annual energy use of a building.

Rated Feature	Reference Home	Houston Habitat Home
Space Cooling (MBTU)	10.9	3.9
Space Heating (MBTU)	7.3	4.8
Water Heating (MBTU)	16.5	14.5
Total for Rated Features	34.7	23.2
Savings		33% (11.5 MBTU)

Note that *Rated Feature* refers to those categories of energy use addressed in the Home Energy Rating System Guidelines. For example, energy consuming appliances and devices are not included in the heating, cooling, or water heating category directly -- except that the heat that they generate contribute to the cooling load.

Mike Shirl

Memo

Page 2

Non-Rated Features	Reference Home	Houston Habitat Home
Lighting	3.2	3.2
Plug in devices/appliances	15.2	15.2
Misc pumps and fans	0.2	0.2
Total for Non-Rated Features	18.6	18.6
Savings		0% (0MBTU)

In terms of total energy use, which includes the rated and non-rated features, savings for the Houston House appear to be about 20%. Realized savings may vary from this depending on the proportion of appliance and devices used by the family in comparison to the heating, cooling, and water heating use.

	Reference Home	Houston Habitat Home
Total Annual		
Energy Use (MBTU)	53.6	42.1
Savings		21% (11.5 MBTU)

Please call me if you have any questions on this data. We look forward to watching the Houston Habitat Energy House grow into the success it can be!

Best wishes.

Additional notes added 1/22/96:

	Reference Home			Houston Habitat Home		
Total Annual	Gas	Electric	Total	Gas	Electric	Total
Energy Cost	\$295	\$581	\$877	\$254	\$422	\$677
Savings						22.8% (\$200)

Estimated cost of energy improvements: \$1400

Estimated simple payback: 7 years

Actual cost of energy improvements: \$1800 - \$330 (utility rebate) = 1470

Note that energy package for Houston Habitat House 3C-Energy changed slightly during construction from the package simulated.

APPENDIX C

1997 List of Television Viewing Markets for Our House Habitat Show

BLACK DOG
Productions, Inc.

To: Malcolm Verdict

From: Colleen Kennedy

3730 Kirby Drive
Suite 402

Date: 3/19/97

Re: Shows for Spring, 1997

Houston, Texas
77098

Hi, Malcolm! As requested, the following are the markets in which Our House airs. I've categorized them based on the particular show they will air this Spring — Habitat show filmed last Spring, The Affordable Housing show that was filmed in January, and the markets in which neither show will air this season. Hope this helps you out!

Phone

713/522-6766

Fax

713/522-4164

E-Mail

Black DogP@aol.com

Habitat from Spring, 1996

Albuquerque starts 4/5, Habitat airs 5/17

Cincinnati starts 4/12, Habitat airs 5/31

Spokane started 3/9, Habitat airs 4/27

Detroit started 3/15, Habitat airs 5/3

Allentown, PA started 3/15, Habitat airs 5/10

Medford, OR started 3/16, Habitat airs 5/4

Wilkes-Barre, PA starts 3/30, Habitat airs 5/25

Harrisburg, PA starts 3/30, Habitat airs 5/25

Affordable Housing from Winter, 1997

Houston started 1/19, show aired 3/9

Rockford, IL started 3/15, show airs 5/4

Chicago started 3/16, show airs 5/4

Other Markets

Indianapolis starts 4/6

Lexington, KY starts 4/5

Phoenix starts 4/5

Louisville, KY started 3/15

APPENDIX D

HUD Innovative Housing Partnerships Award Letter

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
THE SECRETARY
WASHINGTON, D.C. 20410-0001

January 8, 1997

Mr. Malcolm Verdict
Alliance To Save Energy
1200 East 18th Street, NW
Suite 900
Washington, DC 20036

Dear Mr. Verdict:

On behalf of the National Partners in Homeownership, I am pleased to invite you to a ceremony honoring recipients of Building Innovation for Homeownership awards. At this ceremony, you will receive a plaque that formally recognizes your project's important contribution to expanding affordable housing opportunities through the creative use of innovation in building technology and design.

The awards ceremony will be held on ~~Saturday~~, ~~January 11, 1997, 10:00 am - 12 noon~~, in Houston, Texas, in conjunction with the annual convention of the National Association of Homebuilders (NAHB). Assistant Secretary for Housing-FHA Commissioner, Nicolas P. Retsinas, will present the awards on behalf of the National Partners in Homeownership. Enclosed is an information sheet summarizing the event as well as a phone number to call regarding your attendance.

Although you may have already received your award, I encourage you to attend this important event. I also invite you to notify your local news media that you will be receiving a Building Innovation for Homeownership award at the convention.

Again, let me thank you for your important contribution to meeting our national homeownership goals. Through the use of creativity and technological innovation, as you have so amply demonstrated, I firmly believe that homeownership can be made available to all American families.

Sincerely,

A handwritten signature in black ink, reading "Henry Cisneros", is positioned above the typed name.

Henry G. Cisneros

Enclosure

Chair
Senator Jeff Bingaman
Co-Chairs
Senator James M. Jeffords
Representative Edward J. Markey
Representative John Edward Porter

Founding Chair
Charles H. Percy

Chair Emeriti
Daniel J. Evans
The Late H. John Heinz III
Timothy E. Wirth

President
David M. Nemtsov

Treasurer
Michael E. Barrett
Partner, Coopers & Lybrand

Secretary
Mark Hopkins

Norman R. Augustine
President
Lockheed Martin Corporation

Michael Baly III
President
American Gas Association

Michael R. Bonsignore
Chairman & Chief Executive Officer
Honeywell Inc.

Stephen Brobeck
Executive Director
Consumer Federation of America

Richard H. Cowart
Chairman
Vermont Public Service Board

Carson D. Culbreth
Director of the Energy Division
North Carolina Department of Commerce

John C. Fox
Executive Vice President
Ontario Hydro

Gerald A. Halvorsen
President
Interstate Natural Gas Association
of America

James A. Johnson
Chairman & Chief Executive Officer
Fannie Mae

Thomas R. Kuhn
President
Edison Electric Institute

Dean L. Langford
President
OSRAM SYLVANIA INC.

Jonathan Lash
President
World Resources Institute

Susan A. Maxman
Past President
American Institute of Architects

Earle H. O'Donnell
Partner
Dewey Ballantine

Frank H. Pearl
Chairman
Kappahannock Investment Company

John W. Rowe
President & Chief Executive Officer
New England Electric System

Philip R. Sharp
Director, Institute of Politics
Harvard University

Dixon R. Walker
Senior Vice President
Schuller International

The
ALLIANCE
To Save Energy

August 16, 1996

Building Innovation for Homeownership Program
Affordable Housing Research and Technology Division
Office of Policy Development and Research
U.S. Department of Housing and Urban Development
Room 8132
Washington, D.C. 20410

Re: Building Innovation For Homeownership Program

Dear Sir or Madam:

Attached is a project submittal on behalf of Houston Habitat for Humanity for recognition and participation in the national Building Innovation For Homeownership Program.

This innovative project is an outstanding low-income affordable housing development designed to significantly reduce the life-cycle cost of homeownership through the use of proven energy and resource efficiency techniques. Houston Habitat for Humanity is one of 1,200 Habitat affiliates nationwide who will collectively build over 3,000 low-income homes in 1996. This project is unique in its public-private partnership approach, effective in reducing the cost of homeownership, and serves a model for other builders.

Should you have questions, please contact me at 202-530-2213 or the Reverend E. Michael Shirl, Executive Director of Houston Habitat for Humanity, at 713-521-2816.

Sincerely,

Malcolm E. Verdict, C.E.M.
Director of Research

Enclosure

Houston Habitat for Humanity

**The Energy-Efficient
Affordable Home**

**Submittal to
Building Innovation
for
Homeownership Program**

August 1996

Building Innovation for Homeownership Program

SUBMISSION FORM

SECTION 1. BUILDER/DEVELOPER DATA

Name and Title Reverend E. Michael Shirl

Company: Houston Habitat for Humanity

Address P.O. Box 8467

City Houston

State TX

Zip Code 77288

Phone 713 521-2816 FAX 713 521-0251

Solicited by Malcolm Verdict, Alliance to Save Energy
Washington, D.C. 202-857-0666

☐ Housing Manufacturer

☐ Builder

☐ Designer/Planner

☐ Other (specify)

SECTION 2. PROJECT DATA

a Name and location of State Houston, Texas

b Type of project or development

☒ Detached housing

☐ Attached housing

☐ Other (specify)

c Project description See Attached

Attach text, drawings, photos as appropriate

d Status of construction on going

Scheduled or actual completion date 1st unit completed 1/96

If not yet started or already completed, attach explanation of status (per criteria)

e Housing sales prices

Average unit or home development \$ 41,800 Site sq ft 1,100 - 1,200

Building Innovation for Homeownership Program

SUBMISSION FORM

a. Describe innovative technical aspects of project: See Attached

b. Where applicable or information is available, summarize the following:

- ☒ Proven techniques _____
- ☒ Marketplace availability _____
- ☒ Suitable for builders/developers _____
- ☐ Varies from standard construction _____
- ☒ Cost savings _____
- ☒ Energy/resource efficiency _____
- ☒ Housing quality or comfort _____
- ☐ Other attributes _____

Attach text, drawings, photos as appropriate

SECTION 4: HOUSING AFFORDABILITY

Summarize affordability benefits: See Attached

Attach more details as needed

SECTION 5: OTHER PROJECT ATTRIBUTES

Summarize other project attributes: See Attached

Attach more text as needed

Malcolm E. Verdut

Signature

August 16, 1996

Date

Return with supporting materials as soon as possible, but no later than **September 15, 1996**, to:

Building Innovation for Homeownership Program
Affordable Housing Research and Technology Division
Office of Policy Development and Research
U.S. Department of Housing and Urban Development
Room 8132
Washington, DC 20410

HOUSTON HABITAT FOR HUMANITY
The Energy-Efficient Affordable Home
Attachments

SECTION 2. PROJECT DATA

c. Project Description: In Houston's very hot and humid climate, it is not unusual for low-income families to pay utilities equal to 50% or more of their housing payment in older, inefficient houses. Determined to reverse that trend, Houston Habitat for Humanity (a nonprofit, low-income homebuilder, and Habitat for Humanity International* [HFHI] affiliate) made significant improvements in 1996 to their new single-family homes under development in the Wood Glen Subdivision in Houston, Texas (See Attachment A for plat map). Their house plans were modified to greatly increase the affordability, quality, and comfort through cost-effective energy and resource efficient improvements using readily available building materials.

The "Houston Habitat Energy-Efficient Affordable Home" project is unique for two reasons:

- 1) Houston Habitat permanently adopted a very high level of energy and resource efficiency that exceeds 95 percent of all new houses built in the U.S. according to Environmental Protection Agency (EPA) staff estimates. The upgraded house exceeds the 1993 CABO Model Energy Code by over 30%. They are the first low-income builder nationwide to receive the prestigious ENERGY STAR builder designation from EPA. Houston Habitat will build over 30 homes in 1996 to this new standard and as many as 100 homes in 1998 when the international Jimmy Carter Work Project "blitz build" moves to Houston.
- 2) This house was built by a public-private partnership of federal, state, utility, business, research, and nonprofit organizations to demonstrate the benefits of energy and resource efficiency on housing affordability and the power of forming public-private partnerships (See Attachment B for list of partners). At the project kick-off and ribbon cutting ceremony in January 1996, Millard Fuller, President of Habitat for Humanity International, stated that this looks like "the house that everyone built." One of the other project goals was to serve as a model for other homebuilders nationwide to help expand homeownership opportunities.

* Habitat is a grass-roots organization with local affiliates in more than 1,200 communities. Each affiliate operates autonomously working within certain national covenants and housing standards which include building simple, decent houses at no profit, with no-interest loans for very low-income families. In 1996, Habitat affiliates will build 3,000 homes nationwide. HFHI has built 50,000 homes since its founding 20 years ago by Millard and Linda Fuller.

d. Status of construction - The first house with the enhanced features was completed in January 1996 and occupied the following month (see photos - Attachment C). Houston Habitat will build sixty "Energy-Efficient Affordable Homes" during Phase II construction in their low-income Wood Glen subdivision. Homes are three and four bedroom single-family, site-built, wood-frame construction ranging in size from 1,100 to 1,300 square feet. Labor is primarily volunteer with homeowners required to perform several hundred hours of "sweat equity" prior to occupancy.

SECTION 3. TECHNICAL AND INNOVATIVE ATTRIBUTES

a. Describe innovative technical aspects of the project:

Houston Habitat made a large number of innovative design improvements to its standard plans to enhance housing affordability. The public-private partnership formed a team of energy and environmental design experts who carefully analyzed numerous technical improvements for the "Energy-Efficient Affordable Home." As a result, Houston Habitat increased living space and comfort while significantly reducing homeownership life-cycle costs through lower utilities.

The technical design for this project is highly effective and has been recognized nationally and locally for its high standards and impact on housing affordability:

1) Reduced Life-cycle Costs -- Houston Habitat now utilizes a comprehensive set of energy- and resource-efficient improvements to reduce cooling, heating, and water heating energy use. The Florida Solar Energy Center estimates utility savings of 33 percent (see Attachment D) with a minimal up-front investment of \$1,800 for a 1,100 square foot house. Individual improvements are not unique but the comprehensive application of several readily available enhancements clearly sets this project apart. Houston Habitat is one of a handful of low-income homebuilders nationwide who clearly understand the impact of investing fully in energy efficiency improvements to reduce overall housing costs.

2) Project Recognition -- Houston Habitat was the first low-income homebuilder in the Nation to meet the high efficiency and environmental requirements of the EPA's ENERGY STAR Homes Program. They also qualified for Houston Lighting & Power Company's "Energy-Efficient Affordable Home Program" for low-income homebuilders that significantly increase housing affordability through energy-efficient techniques. This project was nominated this summer for the Department of Energy's Renew America and NAHB Research Center's Energy Value in Housing awards.

b. Where applicable or information is available, summarize the following:

Proven Techniques -- One of the landmark attributes of this project was the use of techniques and materials that have been proven in the homebuilder industry. Houston Habitat required that all design change recommendations meet rigid criteria for cost-effectiveness and ease of acquisition and installation by unskilled labor before being including in the final set of energy and resource efficiency improvements. No one-of-kind or experimental options were considered. All recommendations were approved by Houston Habitat's construction committee, their Executive Director, and construction site supervisor. Houston Habitat obtained all materials and appliances, including donated items, from area distributors and building supply outlets.

To further demonstrate the effectiveness of the technical improvements, extensive on-site metering and monitoring is being conducted by the Texas State Energy Conservation Office and its contractor, Texas A&M University, to verify that all building components and appliances perform as predicted and that the building is being operated correctly by its occupants. Based on

the monitoring results, Houston Habitat will consider additional design changes in 1997 to maximize housing affordability.

Marketplace availability -- The 1996 "Energy-Efficient Affordable House" plan is now standard practice in all Houston Habitat homes. The plans and educational materials were mailed by Houston Habitat to over 1,200 Habitat affiliates nationwide by its partner, the Alliance to Save Energy. The Alliance and Houston Habitat exhibited the innovative techniques to the over 65,000 attendees at the January 1996 National Association of Home Builders convention in Houston, Texas. The enhanced plans are available directly from Habitat for Humanity International and information may be downloaded from several internet web sites including Texas A&M, Houston Habitat, and the Alliance to Save Energy.

Reverend Michael Shirl, Houston Habitat Executive Director, has recommended the design changes to other affiliates at regional and national training workshops and in a letter to his peers. The partnership and design team approach will be presented at a workshop at Habitat's 20th Anniversary Celebration in Atlanta, Georgia. As a result of these actions, the techniques and approach used in this project are widely available in the marketplace.

Suitable for builder/developers -- The comprehensive design is suitable for low-income housing developers nationwide. The project partners worked closely with Houston Habitat to insure that all recommended options were both workable, readily available, and cost-effective. Equally important, all individual techniques in this project are suitable for builders of low-income housing in similar climate zones.

Energy/resource efficiency -- Houston Habitat's standard house plans now include a very comprehensive set of energy and resource efficiency techniques and innovations:

Energy Efficiency Improvements

- ♦ high-efficiency heating and cooling equipment,
- ♦ air infiltration controls and extensive weatherization,
- ♦ programmable thermostat,
- ♦ increased levels of insulation in ceilings, walls, doors, and air ducts,
- ♦ energy-efficient home appliances,
- ♦ energy-efficient water heater, electronic pilot, and relocation out of conditioned space,
- ♦ improved HVAC duct design with mastic sealant,
- ♦ site plan orientation to minimize solar heat gain,
- ♦ enhanced solar shading, roof overhangs, landscaping, and radiant reflective surfaces, and
- ♦ energy-efficient interior and exterior lighting with automated controls.

Resource Efficiency Improvements

- ♦ water conserving plumbing fixtures,
- ♦ resource-efficient building materials,
- ♦ wood waste-minimization framing techniques, and
- ♦ improved indoor air quality with low VOC paints and floor coverings.

(See Attachment E for house plans and a detailed description of improvements).

Housing quality or comfort -- Houston Habitat significantly increased homeowner comfort and the quality of its housing through its new, enhanced design. Simple changes such as utilizing ceiling fans in all bedrooms and living areas helped increase comfort while lowering operating expenses.

Features that increased the total home quality and occupant comfort include:

- increased landscaping for cooling and added land value,
- automated, exterior lighting controls,
- reduced air infiltration and extensive weatherization sealing,
- humidity and indoor air quality controls with low-noise exhaust fans,
- increased air circulation through ceiling fans and window placement for cross ventilation,
- automated HVAC controls using a seven-day seasonally programmable thermostat, and
- improved indoor air quality through the use of low VOC paints and flooring.

SECTION 4. HOUSING AFFORDABILITY

a. Summary of Affordability Benefits:

Increased Homeownership Opportunities-- The primary goal of Houston Habitat for Humanity organization is providing decent, affordable housing for low-income families who otherwise would not be able to realize the many benefits of homeownership. Every dollar invested in Habitat homes are critical since most owners earn significantly less than the Federal poverty guidelines (\$18,220 for a family of five). Using a unique approach of simple designs, volunteer labor, and no-interest financing tailored to homeowner needs, Houston Habitat builds very affordable, quality houses.

Houston Habitat homes cost approximately \$42,000, including energy improvements, land, and the value of all donated labor and materials. This price is less than one-third the median new home price in Houston of \$143,000 and removes one of the major barriers to homeownership for low-income families.

Lower Total Cost of Ownership Achieved -- Houston Habitat concluded that total homeownership costs could be lowered significantly by judiciously investing in energy and resource efficiency upgrades since utilities are the single largest expense of homeownership after the mortgage payment. With the help of their partners, they elected to incorporate energy-efficient techniques and appliances in all future housing.

With a minimal investment of \$1,800 or approximately 4 percent (See Attachment E), Houston Habitat reduced total homeownership costs from day-one. Habitat homeowners' annual housing costs will be \$264 or 9% less on average than the annual costs for the previous design (see table below). This is a significant amount for Houston Habitat's low-income families who have little, if any, extra money.

LIFE-CYCLE SAVINGS

	<u>Standard Home</u>	<u>Energy-Efficient Home</u>	<u>Annual Savings</u>
Cost of Home	\$40,000	\$41,800	
Monthly Payment (20 yr., no-interest loan)	\$167	\$175	\$8 mo. increase
Monthly Utilities (avg. for gas, electric & water)	\$90 to 110	\$60 to 80	\$30 or 33%
Annual Cost of Home Ownership (Average for principal, taxes & utilities)	<u>\$3,204</u>	<u>\$2,940</u>	<u>\$264 or 9%</u>

Homeownership Opportunities Increased Significantly -- Houston Habitat realizes the importance of investing additional money to lower the life-cycle cost of homeownership. The average annual income of the Houston Habitat's clientele is \$14,000 for a family of five compared to the area's average per capita income of \$21,367 (Source: U.S. Bureau of Census 1994 Statistical Abstract). Reverend Shirl stated that a \$264 annual utility savings lowers the income necessary to qualify for a \$42,000 home loan from \$1,250 a month to \$1,100 month.

SECTION 5. OTHER HOMEOWNERSHIP GOALS

Several other goals were achieved by this project in addition to the primary goals of lowering homeownership cost, increasing energy and resource efficiency, and improving comfort and housing quality. The additional goals and accomplishments include:

- 1) Establishing a local affordable housing partnership -- Houston Habitat elected to utilize a highly effective public-private partnership to increase housing affordability through lower total housing cost. Government, utility, business, and nonprofit groups combined forces to accomplish the project goals. Additionally, this group encouraged the creation of other partnerships through its extensive outreach efforts consisting of exhibits, workshops, publication dissemination, and television coverage nationwide (30 minute video enclosed).
- 2) Encouraging adoption of design techniques by other builders nationwide -- This project serves as a model for other housing groups. One of the key goals was to encourage widespread adoption of its innovative techniques by other builders for solving housing affordability issues. Locally, this project was heavily promoted through a televised ribbon-cutting ceremony and through printed media (See Attachment F). The commercial television show produced by one of the project partners and the exhibit to the professional homebuilders at their annual 1996 convention in Houston helped increase national awareness.
- 3) Increased living space -- One of the unexpected benefits of this project was the increased living space gained by relocating the water heater to the attic to reduce interior heat gain.

APPENDIX E

News Articles for 1996 & 1997 Demonstration Projects

Betty Tichich / Chronicle

Homemakers

Peggy McIntosh, Laura Henry, Joni Baird, Linda Fuller, Shirley Wiseman Lach work on a house at 9310 Bella Pine Court Tuesday as part of Habitat for Humanity.

State briefs

Mother charged

SAN MARCOS — The mother of a nearly month-old boy born addicted to cocaine faces a felony charge of injury to a child.

San Marcos police issued an arrest warrant this week for 31-year-old Sharon Crayton. Her baby was born Dec. 29 addicted to cocaine and suffering from fetal alcohol syndrome.

Prosecutors said Crayton went to

purposes.

"For instance, you and your wife are newlyweds and doing what all newlyweds do," village Alderman Annette Dewbre said of at least one incident involving eavesdropping with a microphone. "The next morning you get a phone call and your activities of the night before are played for you over the phone."

FBI agent John Truehitt confirmed Tuesday that he and Sgt. Dusty McCord of the Texas Rangers

Routier t

By **JOHN W. GONZALEZ**
Houston Chronicle

KERRVILLE — With jurors tently watching his every move, Dallas County prosecutor Wednesday held up a glistening knife, kn down over an imaginary victim in front of the jury box and portrayed Darlie Routier fatally stabbing two sleeping sons.

As prosecutor Greg Davis arch the suspected murder weapon on his right shoulder and repeated stabbing motion, an expert on blood stains testified that Davis' movements demonstrated how the blood of both boys could have gotten on the back of their mother's night shirt.

Jurors stood and leaned over the railing to get a better view of the demonstration, which came as the prosecution began winding down the capital murder case after 13 days.

Texas A&M p

By **TODD ACKERMAN**
Houston Chronicle

Texas A&M University is proposing a 42 percent student fee increase to help fund raises for faculty and staff, less than a year after a similar bid was rejected.

A&M System regents will consider the proposed \$10 per semester hour increase at a board meeting

SL
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Semi-

Low-energy, low-cost home showcased at Builders' Show

After attending the National Association of Home Builders Show in 1994, and recognizing the important relationship between Habitat for Humanity and the NAHB, Malcolm Verdict, research director at the Alliance to Save Energy, decided it was time the two organizations joined forces.

Verdict wanted to create a mutually beneficial project that would combine energy efficiency and affordability without compromising quality. The result: the Energy-Affordable Home, an energy-efficient, 1,100-sq-ft home built by the Houston Chapter of Habitat for Humanity and the Alliance to Save Energy. The home was showcased during this year's Builders Show.

"This home is the easiest way to help builders build a more energy-efficient and affordable home," said Verdict. "Hopefully, this project can make a permanent change in the way Habitat for Humanity and NAHB work together."

As partners in the project, industry members such as The Home Depot, Honeywell, Inc., and Schuller International, Inc., played a vital role in the home's development. They and others contributed cost- and energy-efficient materials, appliances and services for maintaining the home.

"Appliance manufacturers were lined up nationally to participate in the project," explained Verdict. "They wanted to give us top-of-the-line items."

Many had to be excluded, however, because "top-of-the-line" usually meant most expensive, and didn't always mean most efficient.

Participating organizations' three-part aim with the project was to increase home affordability for low-income

homeowners by reducing energy costs; display easy-to-install, inexpensive options in the home that Habitat affiliates and builders can use elsewhere; and encourage other volunteer groups to adopt environmentally responsible choices.

The Energy-Affordable Home features:

- an energy-efficient HVAC System
- enhanced insulation
- an energy-efficient utility room
- efficient water heating
- low-energy appliances
- increased ventilation
- solar shading
- efficient lighting.

It also includes low-VOC wall- and floorcoverings, low-flow showerheads, and faucets with no-lead fixtures.

This isn't the first Energy-Affordable Home. "But it's the first time this kind of home opened in conjunction with a Builders' Show," said Verdict. Plans are already underway for an Energy-Affordable Home at next year's show.

—Cheryl Ann Lambert

Faucet maker settles suit

When seven faucet manufacturers settled a California Proposition 65 lawsuit last September, Price Pfister, Inc., was one that didn't. On Jan. 30, however, the Pa-coima, CA-based Black & Decker subsidiary finally settled the four-year-old suit that charged it made faucets that leached unacceptable amounts of lead.

The Proposition 65 Safe Drinking Water and Toxic Enforcement Act of 1986 prohibits the discharge of chemicals that cause "reproductive toxicity" in drinking water. Lead in drinking water has been linked to birth defects and reproductive difficulties in adults.

As part of the settlement, Price Pfister must help fund a lead education program for consumers and pay a portion of the court fees for one of the environmental groups that initiated the suit.

—Cheryl Ann Lambert

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Houston Chronicle Nov. 23, 1996

Energy-saving homes help

ENERGY-EFFICIENT homes have debuted on the low-income housing market in Houston and have won accolades from everyone involved.

The solar-reducing design, showcased in northeast Houston's Wood Glen subdivision, won an award last week from the National Partners in Home Ownership for making affordable housing available to more people.

Mike Shiri, executive director of Houston Habitat for Humanity, announced he would use the design for all the homes his organization builds in the future. Sixty-five have already gone up in Wood Glen. Another 30 will dot the horizon by the end of the year.

"These homes are a prime example of why energy efficiency should be built into every home in America, including homes for low-income families," said David M. Nemtsov, president of the Alliance to Save Energy.

The alliance formed a partnership with Houston Lighting & Power, the U.S. Department of Energy and the Environmental Protection Agency.

Henry Cisneros, secretary of housing and urban development, deemed the project "a fine exam-

ple of how the best of American creativity and innovation can help expand home ownership opportunities for all Americans."

The three- and four-bedroom homes boast solar screens that keep the heat of the sun out, improved air distribution with better-sealed ducts, high-efficiency central air conditioning and higher insulation levels.

The design shaves \$25 to \$35 a month off the average utility bill, said Dan Dippon, HL&P supervisor of residential services. HL&P built the prototype for a home-builders convention held in Houston in January.

"Because of the energy savings that are in it, it means that people with less income can qualify," Dippon said. "It is going to save that homebuyer money forever every year."

Shiri brimmed with enthusiasm.

"The main benefit of this program for homeowners who come from moderate- and low-income households is that they save money," Shiri said. "And with limited cash, every dollar you can save is a dollar you can put toward educating your children and toward saving for the future."

Jennifer Lenhart

Wrap-up is a weekly "reporter's notebook" column, featuring news,

information and observations compiled by Chronicle staff members.

Women Go to Work on Habitat House

All-Women Team Building Energy-Efficient Home

A team of enterprising all-women builders and volunteers is constructing an affordable, energy-efficient house during the NAHB Builders' Show this week for Houston Habitat for Humanity.

1989 NAHB President Shirley Wiseman Lach and Linda Fuller, wife of Habitat for Humanity International's founder and 1996 NAHB Hall of Fame award-winner Millard Fuller, are leading the female home-building team.

The house has won praise for its energy-saving features. A design team of energy and local utility experts led by the Alliance to Save Energy — a coalition of prominent government, business, consumer and environmental leaders who promote the efficient and clean use of energy worldwide — estimates that the Houston Habitat house will save the new home owner up to 30% annually on utilities.

Houston Habitat's energy-saving approach won acclaim from HUD for increasing homeownership through lower utilities, met the rigid requirements of Houston Lighting and Power's (HL&P) Affordable Home Program, and was designated an Energy Star Home under the joint Environmental Protection Agency and Department of Energy Energy Star Program. The house also will exceed the local energy code by 30%.

For less than \$42,000, the female builders — skilled and unskilled volunteers — are constructing a three-bedroom, 1,100-square-foot home with numerous, readily available products that increase the home's affordability and comfort. The house features high-efficiency central heating, cooling and water heating; window shading; en-

ergy-efficient lighting; and air infiltration controls. The insulation package was calculated using Schuller International's proprietary Performance Home Program software and includes ComfortTherm encapsulated insulation. This software was recognized by NAHB for promoting market-based approaches to cost-effective, energy-efficient home design and by Freddie Mac for qualifying for an energy efficient mortgage.

No stranger to affordable housing, Habitat for Humanity International built and financed more than 3,000 low-income homes nationally in 1996. Mike Shirl, director of Houston Habitat, announced that he will use this award-winning design in all future homes. Houston Habitat has built more than 65 homes in its northeast Houston Wood Glen Subdivision and will soon complete another 35. Houston also has been selected as the site for the 1998 Jimmy Carter Work Project with 100 energy-saving homes planned for a one-week blitz build.

In addition to the volunteer labor, this house was made possible through a major cash contribution and insulation materials from the Schuller Corporation along with equipment and support from AES Houston-Carrier, C.W. Henderson Electric, Honeywell and Stanley Tools. Promotion and media were provided by Sunny 99.1 FM and HL&P's award-winning "Our House" television show. Design and technical assistance were provided by DOE, EPA, HL&P, the Texas State Energy Conservation Office and their contractors.

For more information, visit the Habitat booth in the Astrotouch or contact Malcolm Verdier with the Alliance to Save Energy at 202-546-0215.

NATION'S BUILDING NEWS

NATIONAL ASSOCIATION OF HOMEBUILDERS
JANUARY 26, 1996

THE VOICE OF AMERICA'S HOUSING INDUSTRY
CONVENTION ISSUE NUMBER 12

Habitat for Humanity

(Continued from page 3)

Environmental Protection Agency.

Contributors of appliances and other products include Browning-Ferris Industries, Carrier Corporation, Frigidaire, Henderson Electric, Home Depot, Honeywell Inc., L.D. Brinkman, Marek Brothers, Morrison Supply, Quality Cabinets, Schuller International, State Industries and Whirlpool Corporation.

The Habitat Energy-Affordable Home incorporates several efficient design techniques and technologies that help it exceed the projected energy savings of the Council of American Building Officials' Model Energy Code by more than 30%. This new design also meets the energy requirements for HL&P's Good Cents Program and EPA's Residential Energy Star Homes Program. The actual energy savings will be metered and monitored by the Texas State Energy Conservation Office.

"This new, cost-effective design will dramatically increase home affordability for low-income Habitat home owners by significantly reducing energy costs," said Brian Binash, executive vice president of Emerald Homes. The

NAHB Research Center recently honored Emerald Homes with an "Energy Value in Housing" award for energy efficient design.

The Habitat Energy-Affordable Home features a high-efficiency air conditioning and gas furnace system, programmable thermostat, energy conserving duct design, increased ceiling and wall insulation, natural ventilation, efficient lighting, improved window shading and orientation, and water conserving features.

Rev. Mike Shirl, executive director of the Houston Habitat for Humanity, said his organization "plans to use this improved design in all of the homes we construct in the future."

"These cost-effective energy efficient options will be shared with Habitat affiliates and builders nationwide so they may utilize the same approaches, making housing more affordable for all Habitat home owners," added Malcolm Verdict, director of research for the Alliance to Save Energy.

A model of the Habitat Energy-Affordable Home and design materials are on display at the Habitat International exhibit booth, and the house is included in the NAHB tour of homes.

Houston Builders Lend A Hand to Habitat on 'Energy Affordable Home'

Houston-area home builders have joined with the local Habitat for Humanity affiliate and several other partners to construct an energy- and resource-efficient demonstration house that will help reduce the energy bills of low-income Habitat home owners.

The Energy-Affordable Home will be on display throughout the convention, and Habitat for Humanity President Millard Fuller will join with the project's other partners in a ribbon-cutting ceremony at the house this afternoon.

Local partners in the project include Emerald Homes, Greater Houston Builders Association, Houston AIA — Environmental Committee, Houston Habitat for Humanity and Houston Lighting and Power Company. National and state partners include the Alliance to Save Energy, which coordinated the project, Habitat for Humanity International, the NAHB Standing Committee on Energy, Texas State Energy Conservation Office, U.S. Department of Energy and U.S. Environment.

Continued on page 12
JANUARY 26, 1996

Energy-efficiency effort shows pos

A specially equipped house had a 25 percent lower energy bill each month.

By Alan J. Heavens
INQUIRER REAL ESTATE WRITER

The challenge for low- and moderate-income families is to find housing that is affordable to buy and affordable to live in.

It's becoming easier for such families to buy homes, thanks to a variety of programs specially designed to make it happen.

But the question, which often goes unanswered, is how people on limited incomes can afford the monthly maintenance and utility costs as well as the mortgage.

Surveys by the U.S. Department of Housing and Urban Development show that low-income families spend 20 percent to 30 percent of their income on utility bills. Middle-income homeowners typically spend 10 percent to 15 percent.

One way to handle this situation is to find ways during the construction or renovation of a "low-mod" house to make the finished product more energy-efficient.

This strategy works for mainstream builders such as Scott Cannon, whose Yorktown 1781 community in Delaware County recently won an award from the National Association of Home Builders Research Center for "integrating energy efficiency" into the production of his houses.

"When you buy a home, you also buy maintenance and energy costs," Cannon said. "And you pay for those costs with after-tax dollars.

"Energy efficiency means a lot more to your pocket. And energy efficiency goes hand in hand with quality. But the problem with a lot of buyers is that they don't care."

However, low- and moderate-income buyers should care. Energy costs can affect affordability. By lowering utility bills, the median qualifying income for a family seeking to buy a house could be reduced, thus making homeownership available to more people.

With this in mind, Habitat for Humanity, the world's largest nonprofit provider of housing to low-income people, built a house in Houston's Wood Glen subdivision that incorporates such energy-efficient features. The house was built for a real family, but also served to showcase energy-saving ideas for the country's builders at a recent convention.

In Houston, where oppressive heat and humidity reign almost year-round, monthly utility bills for Habitat homeowners range from \$90 to \$110 on average.

According to Dan Dippon, an energy expert with Houston Power & Light Co.'s

The energy-efficient house built by Houston's Habitat for Humanity reduces a \$35 a month, compared with regular houses. This makes the house affordable

"Good Cents" home program, "low-income homeowners often use a disproportionately high percentage of their income for utility bills."

By reducing average utility bills \$25 to \$35 monthly, the median Habitat family-income qualifying requirements would fall to \$1,100 from \$1,250 a month, according to Mike Shirl, executive director of Houston Habitat.

That could open homeownership to a lot more people.

The energy and environmental features had to be sensible, cost-effective and easy to install. They also could be tailored to other areas of the country and to houses in any price range. For homes in a temperate area such as Philadelphia, savings would come from such features as better insulation, a high-efficiency furnace, a programmable thermostat, and efficiency in lighting and water use.

The 1,104-square-foot, three-bedroom Houston home, owned by Jacquelin Small, was the product of a partnership of a number of national, state and Houston-area groups and companies, led by the Houston Habitat chapter and the Alliance to Save Energy in Washington.

The partnership included home builders, energy and environmental design staff, energy-efficiency experts from utility companies, appliance manufacturers, and federal and Texas state agencies, as well as Habitat volunteers.

One goal of the project was to demon-

strate simple, low-cost options so that Habitat affiliates and professional builders nationwide would consider many of the same approaches, according to Malcolm Verdict, the alliance's director and coordinator of the Houston project. The house was open for tours in January during the National Association of Home Builders convention in Houston.

"Saving energy requires careful selection of many options as well as quality housing construction, which presents special challenges for organizations ... using volunteer labor," Verdict said.

Shirl said he was encouraged by the project, adding that future Houston Habitat housing would incorporate energy-saving measures.

The package added \$1,800 to the first costs of the house, but had "a positive monthly cash benefit from the beginning to the homeowners, with an estimated average simple payback of eight years," Verdict said. Included in the package were:

- An energy-efficient heating, ventilation and cooling (HVAC) system. Features are a programmable digital thermostat, properly sized for heating and cooling loads; a high-efficiency gas furnace with electronic ignition; upgraded duct installation and use of mastic to seal joints; and a 12.0 SEER (seasonal energy-efficiency ratio) air conditioner.

- Improved insulation. R-30 ceiling and R-16 wall insulation, optimized for local climate conditions, with vapor barriers (the

FOR IMMEDIATE RELEASE: Friday, January 26, 1995

FOR MORE INFORMATION: Mary Ann Gourlay, Alliance to Save Energy, 202/857-0666
Cindy Conte, Houston Lighting & Power, 713/229-7702

Houston Habitat's New 'Energy-Affordable Home' to Serve as Model for Increasing Housing Affordability for Low-Income Families

HOUSTON — Houston Habitat for Humanity has joined with local builders and several other partners to construct an energy- and resource-efficient demonstration house whose design will help make housing more affordable for low-income Habitat homeowners nationwide.

Mike Shirl, Executive Director of Houston Habitat, said his organization plans to use this improved design in all of the homes it constructs in the future. "Habitat affiliates and builders nationwide should adopt the simple, lower-cost, readily available materials and technologies that can help ease the burden of energy bills and make housing more affordable for low-income homeowners," Shirl said.

The Habitat Energy-Affordable Home incorporates several efficient design features and appliances that help it meet the energy requirements for Houston Lighting & Power Co.'s (HL&P) Good Cents Home Program and the U.S. Environmental Protection Agency's Residential Energy Star Program. This new design also helps the home exceed the projected energy savings of the Council of American Building Officials' Model Energy Code. The actual energy savings will be metered and quantified by the Texas State Energy Conservation Office and Texas A&M University.

Average monthly utility bills for Habitat homeowners in Houston's extremely humid and hot climate range from \$90 to \$110. "The cost-effective design of this house will dramatically increase home affordability for low-income Habitat homeowners by reducing their monthly heating, cooling and hot water costs an average of 30 percent," said Dan Dippon, of HL&P's Good Cents Home Program, who noted that low-income homeowners often use a disproportionately high percentage of their income for utility bills. Houston Habitat's Shirl also pointed out that "lower monthly energy bills mean that the median Habitat family income qualifying requirements can drop from \$1,250 a month to \$1,100 a month."

The Houston Habitat Energy-Affordable Home features a high-efficiency air conditioning and heating system, programmable thermostat, energy conserving duct design, increased ceiling and wall insulation, natural ventilation, efficient lighting, improved window shading and orientation, and water conserving features. The energy package adds roughly \$1,800 to the first cost of the home, yielding a positive cash benefit to the homeowners from the start, with an estimated average simple payback of eight years.

"This unique partnership by Houston Habitat and its partners goes well beyond affordable, energy-conscious design by clearly demonstrating the advantages of a team approach to energy-efficient and environmentally sound construction," said Malcolm Verdict, Director of Research for the Alliance to Save Energy. "This team approach can be easily replicated at the local level by a combination of volunteer-based organizations, energy-conscious home builders, design professionals, utility energy efficiency experts, and manufacturers and suppliers of efficient equipment, materials and appliances."

Local partners in the project include Emerald Homes, Greater Houston Builders Association, Houston AIA - Environment Committee, Houston Habitat for Humanity, HL&P and Rasbach Designs/Provident Homes. National and state partners include the Alliance to Save Energy, Florida Solar Energy Center, Habitat for Humanity International, NAHB Standing Committee on Energy, Texas A&M Energy Systems Laboratory, Texas State Energy Conservation Office, U.S. Department of Energy and Oak Ridge National Laboratory, and the U.S. Environmental Protection Agency.

Product and appliance contributors include Browning-Ferris Industries, Carrier Corporation, Frigidaire, C.W. Henderson Electric Inc., Home Depot, Honeywell Inc., L.D. Brinkman/Congoleum, Marek Brothers, Morrison Supply, Quality Cabinets, Schuller International, State Industries/Ferguson Enterprises Inc., and Whirlpool Corporation.

sitive effects for builders, buyers

energy bills by an average of \$25 to
to a wider range of families.

higher the R factor, the better the insulation). There also is exterior rigid foam sheathing with taped joints, insulated exterior doors with weather stripping and airtight thresholds. There also is an insulated, weather-stripped attic access ladder.

- Energy-efficient utility room. The furnace unit is in a fully ventilated, non-air-conditioned space within the utility room, and uses outside air for combustion. There also is an insulated, weather-stripped, furnace-room door.

- A high-efficiency water heater in non-air-conditioned attic space. The water heater has an electronic ignition, insulated inlet-outlet supply lines with convective heat traps, a temperature setting of 120 to 130 degrees Fahrenheit, and a properly sized tank.

- Refrigerator, washer, dryer and water heater that meet or exceed the minimum national appliance energy standard.

- A kitchen with efficient fluorescent lights. Exterior security lighting uses photocell controls and lower-wattage bulbs.

- A low-flow shower head, faucets and no-lead fixtures. These conserve water.

- Living and sleeping areas that use natural cross-ventilation through operable windows. Bedrooms and major living areas have reversible ceiling fans for improved air circulation in the summer and winter. There are continuous ridge and soffit vents for maximum, non-mechanical cooling of attic space. Switch-controlled exhaust fans in the bath and cooking areas control hu-

A Houston Power & Light technician installs a windmill that generates alternative energy for use in the Habitat for Humanity house.

midity and air quality.

- For hotter climates, a covered front porch that fully shades the front door and windows. To reduce unwanted solar heating in such areas, there are two-foot roof overhangs and solar window screens, an east-west orientation of the long axis of the house, and white vinyl siding and light-colored roof shingles. For summer along the East Coast, the solar screens might be an option.

Texas A&M University's Energy System Laboratory and the Texas State Energy Conservation Office will monitor the house for a year to determine the actual energy savings.

An analysis of the house as built by the Florida Solar Energy Center (FSEC) and the U.S. Department of Energy predicts that there will be a 30 percent reduction in heating, cooling and water-heating costs compared with existing houses in the Wood Glen subdivision.

A reason that test houses for energy efficiency tend to be built in the South is that energy costs are often higher in hotter and more humid climates, where cooling depends primarily on electricity to run air-conditioning systems. In cooler climates,

where heating is the primary need, consumers can choose between electricity, fuel oil and natural gas. The choice makes energy costs more manageable.

Recent FSEC monitoring of 10 Habitat houses in Florida City, Fla., indicated that almost 50 percent of energy consumption was for cooling. The Houston Habitat home was designed to meet FSEC recommendations for increased insulation, better ventilation, solar shading, and more efficient equipment and appliances, Verdict said.

He said that a key component to continued savings on energy costs is homeowner education "that provides an understanding of home operation on monthly utility expenses." Studies of low-income weatherization done by the alliance indicate that energy savings can increase by as much as 5 percent and persist over time if homeowners are shown how to do it.

Meanwhile, Shirl was enthusiastic about the project and its potential for expanding homeownership in Houston and elsewhere. His bottom line: "Simple, low-cost, readily available materials and technologies can help ease the burden ... and make housing more affordable for low-income homeowners."

APPENDIX F

Texas A&M Habitat Metering & Monitoring Website

The Texas State Energy Conservation Office Funds Project to Provide Monitoring & Analysis Assistance with Habitat for Humanity - Houston

The State Energy Conservation Office, is providing assistance to an Alliance to Save Energy-led project to demonstrate the use of energy efficient construction methods in a Habitat for Humanity housing development in Houston, Texas. Construction of the energy efficient home took place in the fall of 1995, and it was featured at the National Association of Home Builders convention in Houston during January 26-29, 1996.

ESL will install an energy data logger to record electrical and natural gas energy usage, interior space temperature and humidity conditions, and weather instrument data including temperature, humidity, solar, and wind. The energy usage and interior space conditions of another nearby, standard-built home will also be monitored. Plans include 12 months of monitoring followed by analysis of the results.

The expected long-term benefits of the entire effort include:

- ☐ Houston Habitat for Humanity Executive Director Mike Shirl has announced that all future homes constructed by his organization will incorporate the improved energy features designed for the energy efficient home.
- ☐ The home meets the energy requirements for Houston Lighting & Power's Good Cents Home Program and EPA's Residential Energy Star Homes Program, and exceeds the CABO Model Energy Code by 30 percent. The residents of the homes will benefit by lower energy bills.
- ☐ Check this site in the future for pictures of the home, installation of the logging equipment, and an update on the project.

Contributed by James A. Eggebrecht - Research Associate, ESL (jim@esl.tamu.edu)

[More Habitat for Humanity web sites](#)

AIR CONDITIONER ELECTRICITY USE AND INDOOR TEMPERATURES IN THE ENERGY EFFICIENT HOUSE AND STANDARD EFFICIENCY HOUSE.

Jeff S. Haberl, Agami Reddy, Tarek Bou Saada
Energy Systems Laboratory
Texas A&M University

October 1996

The following figures provide a preliminary look at the air conditioner electricity use and indoor temperatures for the energy efficient house and the standard efficiency house at the Habitat for Humanities community in Houston. The data shown cover the 1996 summer cooling season through September and represent a period where very little or no homeowner contact had been made.

In Figure 1 the hourly electricity use by the energy efficient air conditioner (EE) and standard efficiency air conditioner (SE) is shown plotted against the outdoor temperature recorded at the site. Several features in the data are apparent. First, there is about a 600 Watt difference between the maximum electricity use of the standard efficiency air conditioner and the energy efficient air conditioner. This indicates that the energy efficient air conditioner is consuming much less electricity than the standard efficiency house

Both air conditioners exhibit roughly the same temperature induced rise in maximum electricity use as the outside air temperature rises. In the energy efficient air conditioner it also appears that there are multiple states of maximum energy use which could be indicating a multi-speed fan on the condensing unit. The in-situ efficiency of the air conditioners is needed as an input to the DOE-2 program in order to evaluate the overall impact on the house's energy use and to begin to separate the contributions of the envelope ECOs

In Figure 2 we show another confounding factor in the energy analysis of the two houses that concerns the indoor temperatures which reflects differences in the thermostat settings of the two homeowners. In the standard efficiency house the homeowner would set back or turn off the air conditioner when not occupied. In the energy efficiency house the homeowner was leaving the air conditioner on during unoccupied times. This can clearly be seen in the plots of the hourly indoor temperature use versus ambient temperature

In the energy efficient house the majority of the points cluster around 70 F, regardless of temperature. In the standard efficiency house the indoor temperature represents a range of points between 70 and 80 F. Both houses show an unusual group of outlier points that continue to drop when the ambient temperatures dropped below 60 F. These points represent the period when the cold front came through Houston on September 26th, 1996 and probably indicate that neither homeowner turned on the heating system during that period

Our visit to the site on September 10th, 1996 revealed that there was a programmable thermostat in the energy efficient house and a non-programmable thermostat in the standard efficiency house. Neither house had any operating instructions for the heating/cooling systems. In the case of the energy efficient house we also could not find operating instructions for the programmable thermostat. Both homeowners did not recall receiving any training about how to operate their systems, including the changing of filters, operation of the thermostat and use of the emergency shut-off switch for the 24 VAC control thermostat.

Immediately prior to the September 10th, 1996 visit the energy efficient homeowner was informed that she could reduce her energy use by turning off her air conditioning system and we did notice a drop in the daytime use just prior to the visit. However, she was still leaving the ceiling fans on during the unoccupied periods which consumes a small amount of electricity (about 180 Watts). The small group of break-away points above the 70 F average on the graph indicate the changed behavior after the September 10th visit

A quick look at the difference in the energy use of the energy efficient house before and after the period when she began to turn off the air conditioner indicates that this has had an enormous impact on her energy use. Clearly, the need for improved homeowner training is as important as the ECOs that are being installed

Recent inspection plots of the weekly energy use for both houses are also included

Figure 1: Hourly Air Conditioner Electricity Use for the Energy Efficiency House and the Standard Efficiency House Versus Outdoor Temperature.

SEH WH Electric (kWh/h)

Temperature (F)

Relative Humidity (%)

Solar Radiation (w/sqm)

SEH Air Cond (kWh/h)

SEH Furnace Run Time

SEH Other Electric (kWh/h)

SEH Indoor Temp (F)

SEH Air Cond (kWh/h)

SEH Furnace Run Time

SEH Other Electric (kWh/h)

SEH Indoor Rel Hum (%)

EEH WH Electric (kWh/h)

Temperature (F)

Relative Humidity (%)

Solar Radiation (w/sqm)

HH Beginning 09-24-1996

EEH Air Cond. (kWh/h)

EEH Electric (kWh/h)

EEH Other Electric (kWh/h)

EEH Indoor Temp (F)

HH Beginning 09-24-1996

EEH Air Cond. (kWh/h)

EEH Electric (kWh/h)

EEH Other Electric (kWh/h)

EEH Indoor Rel. Hum (%)

HH Beginning 09-24-1996

Weather Station that Measures Outdoor Temperature, Relative Humidity, Wind Speed, and Solar Radiation

Electrical Sensors Being Installed that Measure the Whole-Building and Air Conditioner Electricity Use

The Habitat for Humanity Energy Efficient Home

Energy Efficient Domestic Water Heater

State of the Art Home Climate Control

Computerized Data Acquisition System for Hourly Energy Monitoring

Example of a Weekly Inspection Plot Showing Hourly Electricity Use, Indoor Conditions, and Ambient Conditions