THE JOHN C. STENNIS
INSTITUTE OF GOVERNMENT

§ BRIEFING PAPER

HOUSING STRATEGIES FOR MISSISSIPPI

A BRIEFING PAPER ON POLICY ISSUES RELATED TO
HOUSING NEEDS WITHIN THE STATE OF MISSISSIPPI

This policy paper details a specific housing strategy with potential to — while assisting with reconstruction from the catastrophic impact of Hurricane Katrina — provide for construction of high-quality, energy efficient residential housing, create homeownership opportunities for low-income families, and further, provide funding for critical community needs.

Although elements of this proposal can be adopted in isolation and individually remain effective to help solve the state's critical housing needs, a comprehensive approach toward the adoption of this strategy will create longitudinally-sustainable programs targeted toward needs found throughout the state's local communities. Mississippi is at a critical historical juncture; indeed, the burden of leadership that the citizens of Mississippi have bestowed upon their elected leaders has rarely been more profound.

This document is intended to solicit support for the implementation of the proposed strategy. The Stennis Institute of Government is prepared to provide significant technical assistance, upon request.

For specific questions or comments related to this document, or additional information related to similar topics, please contact the author.

Judith Phillips
☎ (662) 325-3329 or (662) 325-3328
phillips@sig.msstate.edu

Introduction

Over the past three years, The John C. Stennis Institute of Government at Mississippi State University has conducted research and assisted communities to develop strategies to address the needs of low-income residents. This document discusses the important public policy issues associated with the deep need within the state to create homeownership opportunities for low-income families, the requirement that low-income housing is of high-quality and energy-efficient, the need to assure that accessibility, pre-school, after-school, and elderly health or elderly daycare is integrated with community planning processes.

As with all its' community design and planning activities, the Institute examines important public policy issues, and then works with local communities to develop localized strategies for addressing these issues; the Institute then assists communities to develop market and financial feasibility analysis and to identify the funding sources and/or financing mechanisms necessary to achieve successful implementation as an outcome of the planning process. Community planning without the ability to implement has no efficacy.

Through research conducted in 2002 through 2003 working with faculty members at the College of Architecture and the Carl Small Town Institute, the Stennis Institute identified structural insulated panels as a critical element within a comprehensive community redevelopment strategy designed to meet the housing needs of low-income families within the state. Stennis then went on to develop work force training programs and to develop financially sustainable strategies to create homeownership programs for low-income families in Mississippi. The initial research originated with a grant from The U.S. Department of Housing and Urban Development's Partnership for Advancing Technology in Housing (PATH) to the College of Architecture at Mississippi State University.

PATH is dedicated to improving the quality, durability, environmental efficiency, and affordability of homes through the use of new technologies. The PATH partnership is supported by numerous federal agencies, including the Departments of Energy, Commerce, Agriculture, the Environmental Protection Agency, and the Federal Emergency Management Agency. Significant investments in research and technology transfer have been made by PATH to encourage the use of structural insulated panels because these panels offer a multitude of benefits and applications to address many national, regional, and local housing issues.

The Institute expanded its work through the initiation of prototype programs such as working with Habitat for Humanity to build housing with Structural Insulated Panels and the establishment of AmeriCorps Rebuilds Mississippi, a work force training program that provides construction training for residents of public housing authorities. These expanded projects were utilized to develop working prototypes to examine concept feasibility and adaptability for replication. The scope of work related to housing, energy-efficiency, and meeting the needs of Mississippi low-income families is outlined in the following paragraphs.

Background

The Search for Energy Efficient, Affordable Housing Solutions

The Federal government has enacted multiple regulations and legislative initiatives, and numerous Federal agencies have implemented programs to encourage energy efficiency in housing in an effort to reduce the negative economic impact of high energy costs and the related depletion of natural resources. These programs include (but are not limited to):

- Section 945 of the 1990 Affordable Housing Act that encourages adopting the model energy code for new construction, advancing a DOE-HUD partnership, utilizing an action plan for reducing the outlay for utilities in public housing, emphasizing energy efficiency in HOPE VI programs, expanding the use of energy-efficient mortgages, improving financing for energy improvements in manufactured housing, and increasing emphasis on sustainable development.

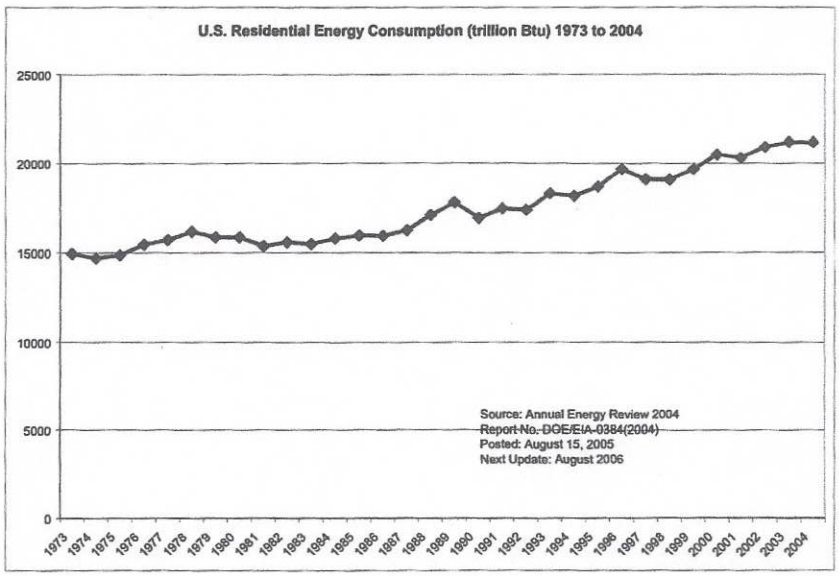
- The Energy Policy Act of 1992 (P.L. 102–486) amended Section 109 of the 1990 Affordable Housing Act to meet energy efficiency standards in all new construction assisted by HUD, including all HOME programs.

- The Model Energy Code (MEC) establishes minimum requirements for energy related features of new buildings and additions to existing buildings.

- The Community Development Block Grant (CDBG) Program Act of 1974, As Amended, (P.L. 93-383) established as one of its primary objectives

> "the development of viable communities by providing decent housing and suitable living environment by expanding economic opportunities, principally for persons of low and moderate income, by providing Federal assistance to support community development activities directed toward the conservation and expansion of the Nation's housing stock and the conservation of the Nation's scarce energy resources, improvement in energy efficiency, and the provision of alternative and renewable energy sources of supply." *(Section 101)*

Under Section 105, activities that may be assisted include: the acquisition, construction, reconstruction, or installation (including design features and improvements with respect to such construction, or installation which promote energy efficiency) of public works and site or other improvements; and grants to neighborhood-based nonprofit organizations to carry out a neighborhood revitalization or community economic development or energy conservation project in furtherance of the objectives of Section 101 {c}. Thirty percent of CDBG funds to states are allocated for use by cities with populations of less than 50,000 to implement the Congressional Energy Mandate.



» FHA Energy-Efficient Mortgages became a Congressionally Mandated national program in 1995 in recognition that reduced utility expenses permit homeowners to pay a higher mortgage.

» The State Energy Program established in 1996 is designed to strengthen the capabilities of States to promote and adopt energy efficiency and renewable energy technologies.

» Building America is a private-public partnership designed to combine the knowledge and resources of industry leaders with the U.S. Department of Energy's technical capabilities to act as a catalyst for change in the home building industry. This program emphasizes a systems engineering approach to produce housing that incorporates energy- and material-saving strategies throughout the design and building process.

» The Partnership for Advancing Technologies in Housing (PATH) is a private/public effort established to develop, demonstrate, and gain widespread market acceptance for the "Next Generation" of American Housing. Partners include the Departments of Energy, Commerce, Agriculture, the Environmental Protection Agency and the Federal Emergency Management Agency.

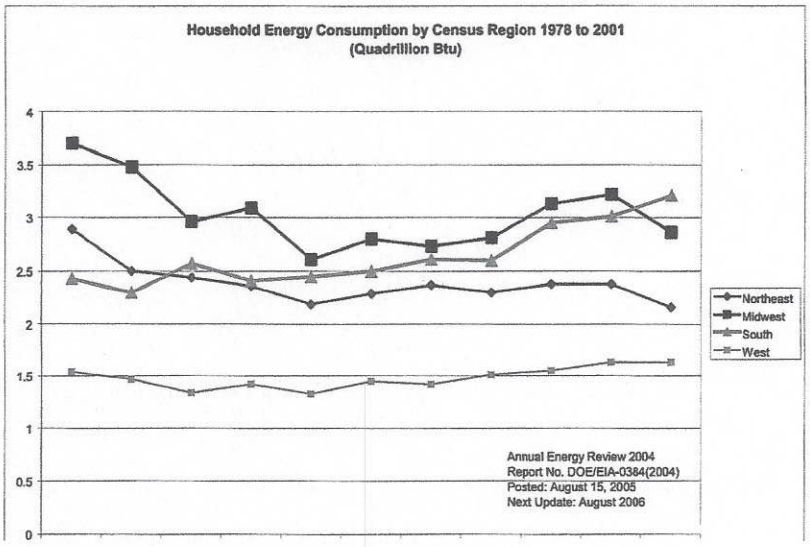
The Importance of Energy-Efficient, Low-Income Housing

Although the importance of energy-efficiency is applicable to housing for all income segments and should be self-evident, a brief review of a few facts and research findings will enable the reader to clearly understand the critical nature of building energy-efficient, low-income housing.

The primary residential source of energy is electricity, fuel oil, and natural gas. Electricity's share of energy consumption has been increasing, while the share of fuel oil and natural gas has been declining.[1] Retail electricity sales exceed sales to both the commercial and industrial sectors.[2] Heating, ventilation, and cooling accounted for 31 percent of electricity sales to U.S. households in 2001 and the increased use of electricity is projected to account for 68 percent of the projected increase in residential energy use between 2003 and 2025.[3] The South Census Region's Btu consumption is the largest of any geographic region in the United States and as indicated in the table below, Btu consumption in this region is increasing compared to other regions of the country.

Out of the fifty states and the District of Columbia (a total of 51 geographic units for which data is reported), Mississippi ranked 30th in Total Expenditures for energy - spending approximately $7.5 billion; and ranked 15th out of 51 in Expenditures per Person for energy.[4] Within the category Total Expenditures for energy, Total Residential Energy Expenditures (in nominal dollars) were approximately $1.8 billion of which $1.24 billion was expended for electricity, $288 million was for natural gas, and $251 million was for liquefied petroleum gas.

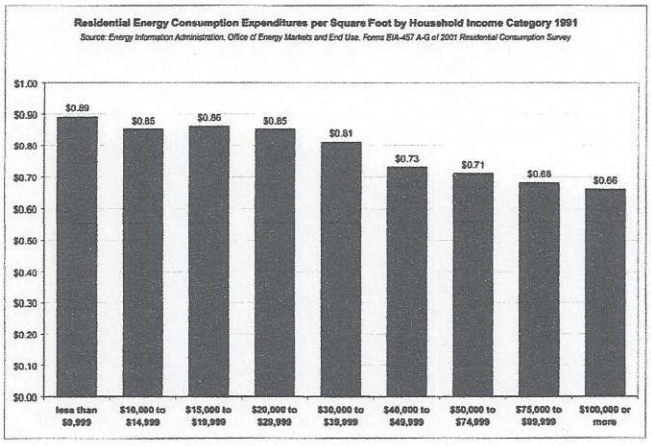
Within the South Census Region, there are three Census

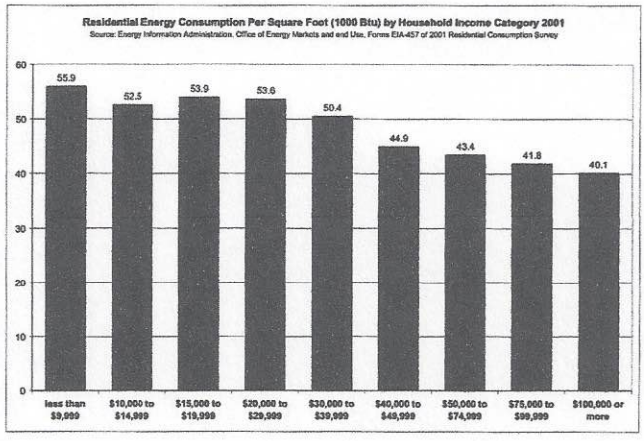


As demonstrated in the following bar graphs, there is an inverse relationship between Household Income and Residential Energy Consumption and Residential Energy Expenditures. Lower income groups consume and expend more per square foot for residential energy than do higher income groups in the United States.

Utility bills burden the poor and can cause homelessness.[5] According to the *Cold Facts*, during the period 1999 to 2000, the typical middle-income household's total energy costs accounted for an average of 4.6 percent of household income; for low-income households total energy costs accounted for 14 percent of household income. During the subsequent period, 2000 to 2001, low-income Americans experienced a 36 percent increase in their energy cost burden resulting in total energy costs accounting for 19.5 percent of total household income.[6] Additional findings presented in this report indicate that a relationship exists between high energy costs and homelessness, malnutrition, and the disintegration of families.[7] Further support for the negative impact of high energy costs on low-income families is provided by the 2005 National Energy Assistance Survey Report of recipients of Low Income Home Energy Assistance Program funding. This

Divisions: 1) the South Atlantic consisting of Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida and the District of Columbia; 2) West South Central containing the states of Texas, Oklahoma, Arkansas, and Louisiana; and 3) East South Central containing the states of Alabama, Kentucky, Tennessee and Mississippi. As demonstrated in the table below, the East South Central Census Division (within which the state of Mississippi is located) exhibits the highest total Btu consumption per household.





Total Btu Consumption (in millions) per Household			
	South Atlantic	East South Central	West South Central
Electricity:			
Primary	140.4	157.6	146.5
Site	47	52.7	49
Natural Gas	61.2	61.6	59.1
LPG	29.1	30	41.1

Source: Energy Information Administration, 2001 Residential Energy Consumption Survey: Household Energy Consumption and Expenditures Tables

report found that due to high energy bills, 32 percent of respondents did not fill their medical prescriptions or took less than a full dose of a prescribed medicine and 16 percent of respondents fell ill as a result of a home that was kept too cold. As residential energy costs increase exponentially, the burden of these costs will impact all Americans – but the disproportional negative impact of energy costs will be most severe for low-income Americans.

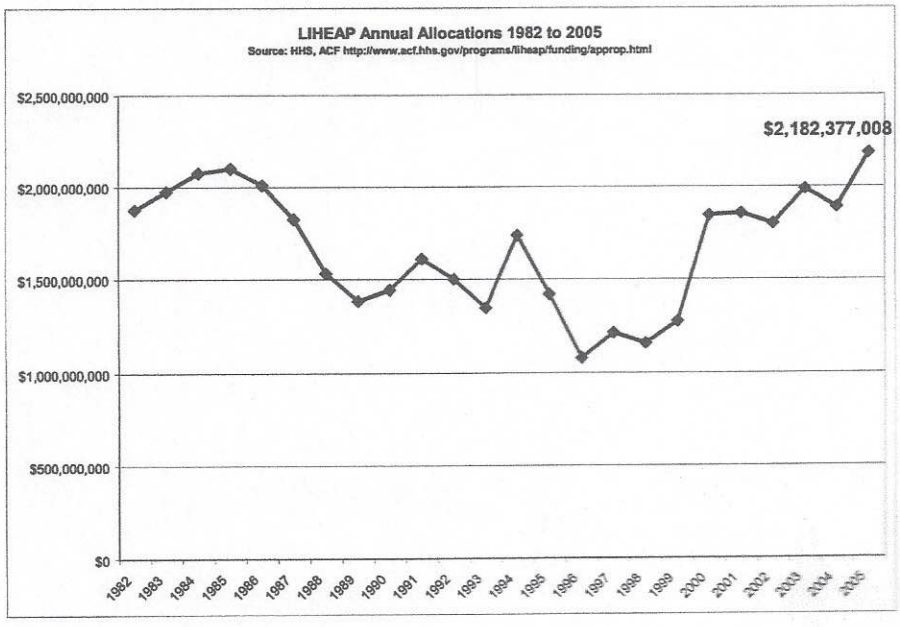
Although there are multiple Federal and State programs that provide financial assistance to low-income persons to offset the burden of residential energy costs, failure to address the core problem – energy inefficient low income housing – can only result in continuously escalating financial and societal burden as energy costs continue to increase. Whether these costs are borne directly by low income households negatively impacting their disposal income for expenditures on other family necessities or absorbed at the Federal or state level through the redistribution of tax revenues does not change the underlying impact of the cost to society related to the failure to implement energy efficient building technologies. For example, according to the U.S. Department of Housing & Urban Development's *Energy Action and Multifamily Housing Plan (2005)*, HUD spends approximately $4 Billion (15% of its total budget) on energy. The U.S. Department of Health & Human Services' (HHS) Low Income Home Energy Assistance Program (LIHEAP) has expended $40.1 Billion during the period 1982 to 2005, on October 12, 2005 the Administration for Children and Families (HHS) announced that it would provide $1.3 Billion to states for energy aid to help low-income families pay their energy bills.[8] Mississippi received approximately $12.3 million for LIHEAP programs for 2005. As demonstrated in the chart below, LIHEAP allocations have been increasing at an increasing rate since 1996 and will increase more dramatically under the Energy Policy Act of 2005 (Public Law 109-58), signed into law by President Bush in August 2005 which increases the authorization of the LIHEAP program to $5.1 billion for each fiscal year 2005 through 2007.

The Linkage between Energy Efficiency and Economic Development

> "On a local level, millions of dollars are being exported out of U.S. cities and counties to pay for energy. This exodus of dollars has very real effects on local economic vitality. City and county leaders across the U.S. often fail to realize that the dollars being spent on energy by their residents, businesses, and industries drain their local economies and would be better spent on public works, consumer goods, industrial site development, and new plants and machinery." [9]

Dollars exported out of communities to pay for energy expenditures are a drain on the economic vitality of the community, when these dollars could instead be spent as consumer expenditures or for other economic development purposes within the community. For example, a study conducted by the Nebraska Energy Office estimates that for each dollar spent on energy, $.80 left the state; compared to typical consumer purchases, for which only $.34 left the state. Increasing energy consumption and related expenditures have a detrimental economic impact at the local, state, and national level.

A special Congressional Energy Mandate in Section 101 of P.L. 93-383 states



> "The Congress finds and declares that the Nation's cities, towns, and smaller urban communities face critical social, economic, and environmental problems arising in significant measure from...increasing energy costs which have seriously undermined the quality and overall effectiveness of local community and housing development activities."

Not only are energy costs a drain on local economies, they are also a drain on Federal programs that provide housing and energy supplements for low-income citizens.

Need for Energy Efficient Housing

Inherent in the linkage between energy costs and the systemic economic development problems faced by communities throughout the South is the exodus of energy-related dollars and the drain these expenditures represent for local economies. These factors further exacerbate the economic hardship faced by many communities in the State of Mississippi, even prior to the catastrophic impact of Hurricane Katrina. The pre-hurricane socio-economic characteristics of the state of Mississippi indicate that the state had a greater need and economic justification for energy-efficient, affordable housing than did other states within the nation. High unemployment, high poverty, coupled with high residential energy usage and the disproportionate impact of energy costs on low income persons substantiates the need to significantly increase the energy efficiency of housing within the state of Mississippi.

Unemployment

As of September, 2005 the State of Mississippi had an unemployment rate (seasonally adjusted) of 9.6 percent, with the exception of Louisiana, Mississippi had the highest unemployment rate of the 50 states in the U.S.[10] According to the U.S. Census Bureau, Mississippi ranks 10th in the nation for unemployment and has the 3rd highest unemployment rate for Females.[11] In April of 2002, Mississippi reported an unemployment rate of 7 percent, a labor force of 1,319,467 and 92,698 persons unemployed.[12] Since the previous year, this represents a 39.3 percent change in the number of persons unemployed. From 1998 to 2002, the state lost 46,636 jobs due to mass layoffs, 10,501 of these were lost in 2001.[13] As a result, the rate of per capita income growth slowed and unemployment increased. Although there have been more recent positive trends in economic growth in the state of Mississippi, a significant long term challenge exists throughout the United States to offset NAFTA and GATT related employment losses within the Manufacturing sector. Historically, within most counties in Mississippi, Manufacturing Sector per capita salary income has been the highest when compared to other industry sectors and has represented the greatest percentage of total employment.

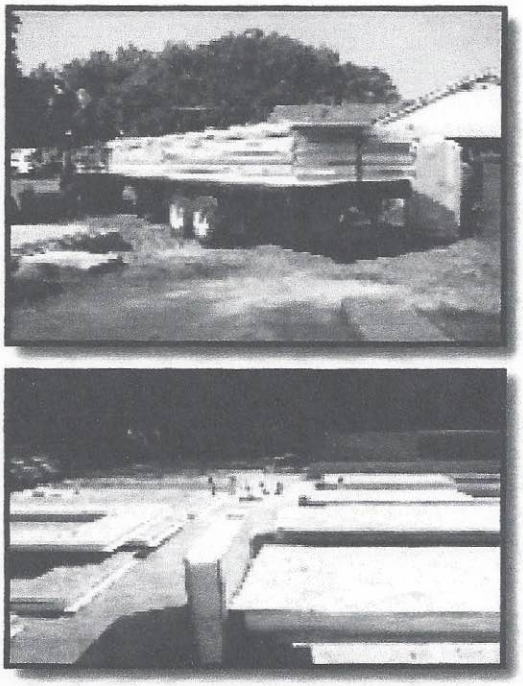
Poverty

According to the U.S. Census Bureau, in 2003 Mississippi ranked third in the nation for the total percentage of the population living in poverty, with 19.9 percent of the population living in poverty. Only Louisiana and the District of Columbia had higher poverty rates, 20.3 percent and 19.9 respectively.[14] The U.S. poverty rate was 12.7 percent in 2003.[15] In Mississippi, 28.6 percent of all children aged 18 and under live in poverty, with Mississippi being the state with the third highest level of children living in poverty when compared with other states (and the District of Columbia); the national level is 17.7 percent. For persons aged 65 and over, the State of Mississippi has the highest percentage (18.8%) of the elderly living in poverty when compared to all other states and the District of Columbia. The pernicious impact of poverty disproportionately impacts minority segments of the state's population and single mothers and their children. For children under 18 years of age in all races, the U.S. poverty rate in 1998 was 18.9 percent, and for African-American children under 18 the rate was 30.9 percent. [16]

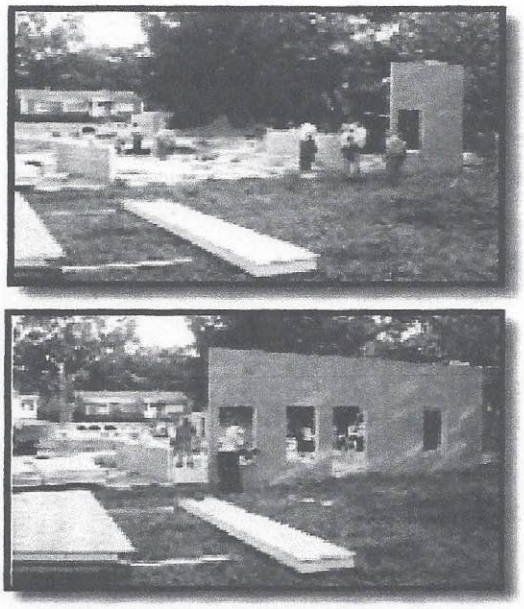
The Housing Gap

Although an increasing number of American households enjoy the benefits of homeownership, minority and low-income household are unable to equitably share in those benefits. Homeownership rates among white households are approximately 74.2 percent compared to 48.5 percent for minority households. In the United States, "*affordable*" housing is frequently defined as single-family residential structures with a median price within a range of $80,000 to $120,000. In the state of Mississippi, the median value of all single-family, owner-occupied residential housing is $71,400.[17] Although the concept of "affordability" includes both rent and utilities, the burden of utility costs is frequently not a priority consideration during the construction of housing for low-income homeowners, nor is consideration given to the disproportionate burden that utility costs impose on low-income homeowners and how those costs impact the ability of the low-income homeowner to meet mortgage payment obligations. In most low-income housing, quality and energy-efficiency are compromised to effect reductions in construction costs. As the cost of energy continues to spiral upward, the cost of utilities for all homeowners is anticipated to escalate placing an increasing burden on low-income home-owners.

In 2002, the Bush Administration committed itself to ensuring that the benefits of homeownership are available for all Americans and announced a new goal to reduce the homeownership gap by increasing minority homeownership by 5.5 million units within the decade. The current Administration's efforts are the continuation of the historical and critical role that the Federal government has played in the expansion of homeownership opportunity for Americans. Over the last century, the federal government has invested in numerous programs that are designed to increase homeownership by the nation's citizens. Beginning with the Homestead Act of 1862, the establishment of the Federal Home Loan Bank Systems in 1932, the establishment of the Federal Housing Administration in 1934, the enactment of the Housing Act of 1949, the Community Reinvestment Act of 1977, and the more recent National Affordable Housing Act of 1990 the Federal government has invested heavily in making homeownership affordable. This commitment is based upon sound economic theory and supported by well-documented empirical evidence of



The house arriving on site..

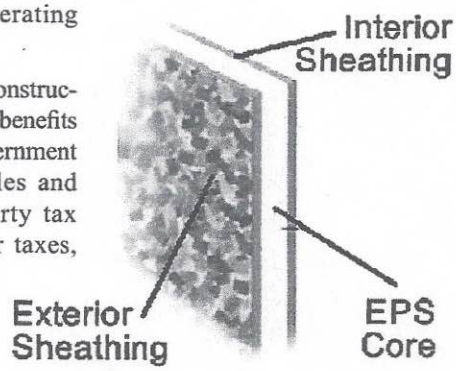


After twenty to forty minutes of work, the exterior walls were more than a quarter complete. All exterior walls were installed in less than three hours..

the public and social benefits that derive from increasing homeownership. Despite these numerous programs, our nation currently falls far short of meeting the Administration's stated objectives of economic development by providing affordable, energy-efficient housing for lower income families.

Economic Development and Homeownership

Stimulating homeownership among low-income households generates new home construction and related employment in a variety of ways. In addition to increasing construction-related employment, jobs are created in transportation, and by increased demand for household goods and services. According to the Consumer Expenditure Survey, average homebuyers of all races who move into a new home spend an additional $4,912 on furnishings and services during their first year of homeownership, thus impacting the local economy by generating additional sales.



Increased home construction and ownership benefits state and local government by increasing sales and residential property tax revenues, transfer taxes, and fees paid for permits, approvals, and impact fees. Home equity represents the largest asset of most Americans and among households with incomes below $20,000, home equity accounts for about 72 percent of total household wealth. Nationally, low-income households spend 30 percent or more of their income on rent, which adds nothing to their net worth. A shift to homeownership provides a savings mechanism for low-income families as their mortgage payments amortize the loan resulting in the accrual of equity in the home, this is particularly true as housing values appreciate in price over time.

Private and Social Benefits of Homeownership

The benefits of homeownership have been broadly investigated by economists, social scientists, and other academic researchers. These findings provide empirical support for the public and social benefits that accrue to communities as an outcome of homeownership. These benefits include

» **Appreciation** of property values and improved residential maintenance in communities with high homeownership levels.[18]

- **Greater community** involvement by homeowners. These benefits include higher voter participation rates, greater involvement in community service organizations, and increased levels of church attendance.[19]

- **Enhanced outcomes** for children. Research has found correlations between improved cognitive stimulation, higher math and reading scores, reduced behavioral problems, higher lifetime incomes, and reductions in teenage pregnancy rates for children living in an owned home.[20]

- **Home equity** enables potential entrepreneurs to gain access to credit markets thereby enhancing small business start-ups.[21]

- **The positive impacts** of new housing construction and homeownership on local schools, cities, and counties. Increases in the total base value of local properties provide additional ad valorem taxes to support essential educational and governmental services, and over the long term are crucial to building and sustaining community viability.

Although significant inroads have been made into the application of technologies that improve the performance characteristics of building components and the energy-efficiency of the building envelope, these building technologies have only received widespread adoption within the upper-income housing market. Virtually no widespread adoption has occurred within the low-income housing market due to the high cost of material inputs, barriers to financial feasibility, lack of knowledge within this sector of the industry, or due to institutionalized resistance to change.

To address these issues, requires innovative approaches to constructing and funding the development of single-family residential housing that integrates cost efficiencies, economies of scale, and good design to create a high quality, energy-efficient home. A recommended solution is the use of structural insulated panels.

Structural Insulated Panels

Structural insulated panels (SIPs) consist of a core layer of rigid foam insulation sandwiched between two structural skins made of oriented strand board (OSB, Plywood, Cement Boards, Steel, or Composit Boards) or steel. The result is an engineered product that provides structural framing, insulation, and exterior sheathing in a solid, one piece component.[22] The standard building practice is to construct the exterior shell of the residential structure using SIPs for walls and roofs are made of conventional trusses of rafters. Sometimes roofs are made of SIPs, however in that cases, significant sagging (displacement of the center of the roof panel) of SIP panels may be a problem. This sagging under dynamic wind load may cause serious loss of the roof air and moisture tightness (ridge connection of SIPs opening and closing under dynamically changing wind pressure). That is why, a very careful design of the roof ridge detail is necessary. In addition SIPs may also be used for flooring. Another common practice is installation of SIP panels over timber frame structure. SIPs are adaptable for a wide variety of architectural designs. In an ideal scenario, SIPs augment the structural capacity of the building envelope and panels are assembled with a minimum of additional framing to form exterior walls or roofs that provide vertical and horizontal load-bearing capacity and increase the thermal resistivity of the building envelope.

Oak Ridge National Laboratories maintains the world's largest material database for wall technologies and the only material database recording the transient characteristics of walls *(see http://www.ornl.gov/sci/roofs+walls/)*. Extensive research conducted by Oak Ridge National Laboratories estimates that in residential and commercial buildings, over fifty percent of energy loss is associated with heat transfer and air leakage through building envelope components.[23] The following paragraph provides a brief overview of the extensive research conducted by Oak Ridge Laboratories[24] on the R-value of building systems:

Existing methods for estimating the R-value of the energy efficiency of building materials are misleading because these calculations or estimates of R-value do not take into consideration the impact of building envelope subsystems such as windows and door frames, construction details such as wall corners, floor and ceiling interfaces, and thermal bridging between insulation and wall studs. Obsolete methods for calculating the R-value of insulation and the thermal performance of the building envelope leads to over-estimation of the true R-value of the building. For example, a conventional wall using wood studs at on-center intervals with batt insulation placed in-between, leads to thermal bridging; relative to batt insulation, wood is a poor insulator, therefore the studs reduce the total system R-value by conducting cold (or heat) into the building at a greater rate than does the insulation (*see http://www.ornl.gov/sci/roofs+walls/AWT/AdvancedWallSystems/home.htm*). A more accurate method for determining the thermal performance of the building envelope is to calculate the "whole wall" R-value of the envelope (*see http://www.ornl.gov/sci/roofs+walls/AWT/InteractiveCalculators/NS/Calc.htm*).

Structural insulated panels may provide superior insulating value to the building envelop due to reduced amount of structural framing and sometimes by higher thermal resistivities of used foams (XPS, PUR, PIR). The combination of the air tightness of SIPs due to the solid foam insulation and the absence of air voids and channels that are present in stud frame with batt-insulation construction make SIPs

A Fort Meyers home constructed with SIPs panels from FischerSips (Louisville, KY) came through the storms undamaged, despite not being completely finished, according to Marc Bronstein, owner of Valubuild Panel Homes Corporation of Boca Raton, FL, who oversaw the home's turnkey construction.

This affordable home in Florida withstood the damage of Hurricane Charley in 2004. It was built with fiber-cement-faced structural insulated wall panels and survived 145 mph winds. The insulated panels are also highly energy efficient.

building envelopes potentially extremely airtight when compared with traditional wood-framed houses. Tests conducted using "whole wall" R-value methods indicate that SIPs may have superior insulating characteristics when compared to wood studs on-center methods of construction. For example, a 6.5" SIP with 5 1/2 " foam core provides an R-value of R-23 compared to a 2 x 6 dimensional framed wall assembly which provides a system value of R-14 due to thermal bridging at the studs. However, in this case, a cost of 6" thick SIPS may be a significant problem. A more economical solution that achieves high energy efficienty in low-income housing is the use of 4.5" SIPS. According to the test data available at the ORNL Hot Box Test R-value Database, a 4.5" SIP with 3.5" foam core provides an R-value of about R-14 (the R-value of traditonal 2"x4" wood framed wall with 22% of framing and insulated with R-13 fiberglass batts is R-10).

In addition to improving the energy-efficiency of residential construction, the use of structural insulated panels provides the following benefits:

Structural Performance of SIP Panels

> "The basic design concept for SIPs is elegant in its simplicity, and offers several advantages for constructing walls and roofs. Bonding the foam core to the stiff outer skins creates a web-and-flange structural strength (along the same principal as an I-beam) across the length and breadth of the panel. With the capacity to handle axial, bending, racking, and shear loads, properly designed and assembled SIPs not only replace conventional framing, but will withstand high wind, and seismic forces."[25]

Depending upon design and manufacture of the SIPs panels and the construction methods utilized, wind resistance of SIPs housing varies. For example, specific manufacturers and builders have developed SIPs housing that withstood 200 m.p.h. winds during the direct hit of Hurricane Charley on Port Charlotte, Florida.[26] This SIPs product utilizes a fiber cement board as the structural exterior and interior membrane, with wall panels tested to meet the requirements of ASTM E 330-90, Standard Test Method for Structural performance of Exterior Windows, Curtain Walls, and Doors by Uniform Air Pressure Difference and is tested to meet the criteria for large missile impacts of SSTD 12-99, a test standard created by the Southern Building Code Congress International (SBCCI), for determining impact resistance from windborne debris.

Speed of Construction

SIPs panels are normally shipped to the jobsite in 4' x 8' panel sizes, but panels of up to 8' x 24' are available. Smaller panels may easily be maneuvered on site by a two-man crew, larger panels require cranes for lifting. Panels are shipped to the jobsite, window and door openings are precut and engineered lumber is pre-installed at the factory for speed of construction and to reduce on-site labor

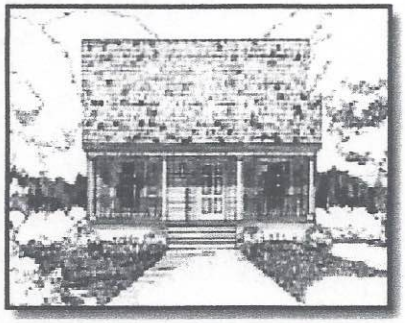
construction costs. After the bottom plate is attached to the perimeter, placement of the wall panels begins. The ease and speed of assembly makes it possible for houses to be placed under roof within days rather than weeks. While basic carpentry skills are required, assemblers need not have the skill levels of conventional framing crews, which can further reduce costs to builders. Some trades may find their work made simpler by SIPs construction. For instance, drywall and siding installers need not worry about locating studs – drywall and dry-in waiting time is zero. Electrical wire chases are pre-drilled through the foam core at the factory, facilitating the wiring process on-site.

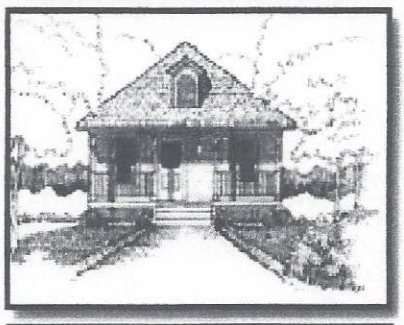
Downsizing the HVAC System

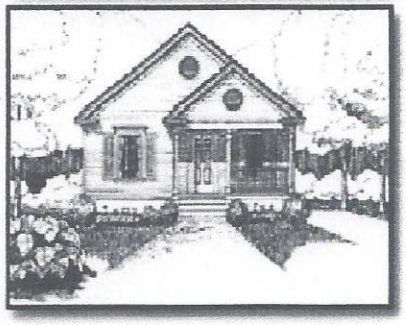
Due to the enhanced efficiency of the SIPs building envelope, HVAC systems may be downsized resulting in increased savings in the finished cost of construction. These air tight building envelopes may require the application of mechanical ventilation and dehumidifiers depending upon climatic conditions and geographic location of residential building sites.

Resource Conservation

Use of SIPs panels can help conserve scarce timber resources, since they provide good structural performance using significantly less dimensional lumber. The lumber used for manufacturing OSB comes from fast growing trees that can be planted and harvested in just a few years. This reduces the consumption of "slow growth trees" with resulting reduction of green house gas emissions.







Design Flexibility

Application of SIPs require development of floorplans which can allow installation of modular wall components. Using SIPs allows for the cost-effective integration of architectural design elements, such as cathedral ceilings, into the design of low-income housing. These design elements create more natural light within the living environment offering the potential for further reduction in energy consumption.

Community Acceptance

Use of SIPs retains the positive characteristics and consumer acceptance of traditional site-built housing and customized community-compatible architectural design, and integrates these positive elements with the efficiencies of scale associated with other less well-accepted housing alternatives, such as manufactured housing or modular housing – many of which do not offer the benefit of energy-efficiency or the safety to the occupants that site-built construction offers.

The utilization of structural insulated panels in the construction of low-income housing creates an opportunity to significantly enhance the energy-efficiency, quality of construction, and engineering performance characteristics of low-income housing when compared to the existing construction methodologies used in the majority of low-income homes in the state of Mississippi.

Variables When Considering the Performance of Structural Insulated Panels

The cost of materials

Efficient use of the SIPs materials is a critical consideration, specifically when utilizing SIPs for low-income housing. The Stennis Institute developed a standardized, rectangular design for a 1,152 square foot home that would optimize material usage and eliminate material waste. This standardized footprint may be sited vertically or horizontally on the building site and customized exterior facades (i.e. brick, siding, porches, columns) enhance the appearance of building elevations. The standardized footprint of the building envelope maximizes cost reductions associated with economies of scale during the manufacturing process plus translates into labor efficiencies during on-site construction. Standardization of window and door sizes

enhance the potential for additional cost savings associated with high volume purchasing of construction inputs, while still allowing for a highly customized exterior façade that avoids the "shoe box" appearance of most low-income housing alternatives and also permits customization of the interior floor plan.

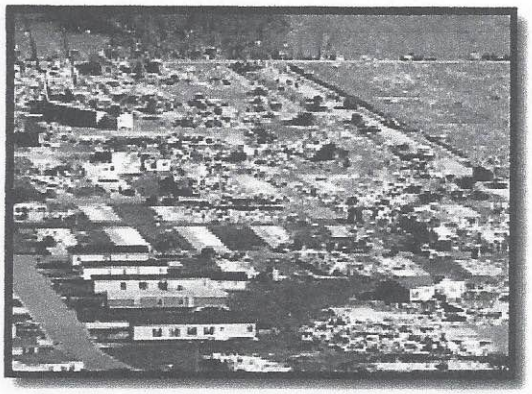
Quality of Manufacture and Building Design

All SIPs do not perform the same. The quality of manufacture is the single most important decision-making factor when deciding to build with SIPs. Foam and panel manufacturers should provide verification that the foam insulating core and structural sheathing components have received appropriate certifications from a third-party testing, listing, certification, and inspection agency that is approved by the National Evaluation Service, Inc. as both a quality assurance agency and as a testing laboratory approved by the International Conference of Building Officials Evaluation Services as both a Quality Assurance Agency, as a testing laboratory, and is in compliance with ISO 25. Third party testing should demonstrate compliance with ICBO, BOCA, and/or SBCCI acceptance criteria for sandwich panels.

Testing Requirements

Panel Load Tests are required of full size panels to determine the ultimate values to which factors of safety may be applied. Only panels that are actually tested are granted recognition, therefore each panel configuration (length, width, thickness, core material and facing material) must be tested. Tests that are recognized by code bodies and the typical tests, calculations, and test reports that are required for sandwich panels that are utilized to construct building envelopes are:

- Transverse load tests per AC04 and ASTM E-72
- Axial load tests per AC04 and ASTM E-72
- Racking shear tests per AC04 and ASTM E-72
- Concentrated load tests per AC04 and ASTM E-72
- Long term deflection "in-situ" test (BOCA only)
- Load tests on headers
- Nail Pull Off Test Resistance per ASTM C-473-84
- Nail/Screw Withdrawal per ASTM D-1037
- Modulus of elasticity per ASTM D-6109, ASTM D-6108, and ASTM D-2719
- Further, the quality of SIP connections can be tested by ORNL using ASTM E 283, "Standard Test Method for Determing Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen" as a guideline.



Evansville, Mobile Home Park hit by tornado, November 2005.

There are many SIPs manufacturers that produce an excellent quality panel, however there also exist many manufacturers that produce an inferior quality of panel. This is the most critical decision-making or adoption issue. Poor manufacture, failure to utilize proper adhesives or p.s.i. to laminate the structural sheathing material to the foam core insulating material or improper curing can result in de-lamination in the field and structural failure of the building envelope. De-lamination creates moisture and mold-growth problems as well. Panels must also be flat, plumb, and have well designed connections to ensure tightness of construction. Quality manufacturers normally use engineered lumber to achieve this purpose.

Insect Infestation

Insects such as carpenter ants, carpenter bees, and termites may become a problem in foam core panels. EPS, polyurethane, and isocyanurate foam provide the ideal environment for an insect nest. In a short period of time, insect colonies can completely honeycomb foam insulation. Some foam core panel manufacturers issue guidelines for preventing insect infestation. These steps include applying insecticides to the panels; utilizing treated engineered lumber for headers, footers, or bracing; treating the ground with insecticides both before and after initial construction backfilling; maintaining indoor humidity levels below 50%; locating outdoor plantings at least 18 inches (457mm) away from the foundation; and trimming away any tree limbs that may overhang the roof. Boric acid-treated insulations are also available in the market. Insecticidal boric acid is a low toxicity insecticide and fire retarder used in other insulation materials."[27] As with all construction methods that utilize wood products, to include structural lumber or OSB, wood serves as a source of food or as nesting material for insects. Building technologies that replace wood with other products result in the reduction of sources for insect infestation; these new products in the market, such as cement or steel-skinned SIPS, have the potential to reduce insect infestation..

A Strategy to Create Homeownership Opportunities for Low-Income Families and Build High Quality Energy Efficient Housing

Working with PermaR (Grenada, Mississippi) and General Panel (Union Mississippi) manufacturers of ASTM certified foam core and SIPs panels, the Stennis Institute developed an efficient, flexible home design that reduces the costs associated with utilizing SIPs and realizes increasing economies of scale related to production and on-site construction. This design optimizes the use of SIPs and is based upon a standardized 24 x 48 building footprint. The external façade and internal floor plan of this 1,152 square foot home can be customized to provide community-compatible architectural design. This home was designed to meet the needs of the low-income housing market in the state of Mississippi with an estimated cost of approximately $70,000 based upon the assumption that building sites and site work would be donated either by municipal, county, or public housing authorities. With nominal additional costs these homes could be built to withstand higher wind loads than the originally estimated 110 to 120 mph design.

The Institute also worked with Housing Authority Region V to develop a multi-unit independent, congregate living facility for elderly persons that utilizes SIPs for a 20-unit facility that features separate external apartment entrances and a centralized hall that provides internal access from each apartment to dining and social common areas, and an on-premises health clinic. This design concept focused on allowing elderly persons to age-in-place and to live independently within a secure environment. The estimated cost of this design is $1.5 million.

The "Post-Katrina" Situation

Pre-Katrina, residential energy expenditures were a drain on the economy of Mississippi and created severe economic hardship for low-income citizens of the state. Building high-quality, energy-efficient low-income housing and creating home ownership opportunities for low-income families was sound public policy due to the economic and societal costs associated with escalating energy costs and the positive private and social benefits that homeownership creates. Structural insulated panels were a financially feasible and sustainable solution to meet Mississippi's low-income housing needs.

With the advent of the catastrophic impact of Hurricane Katrina on the state of Mississippi and the need within the state to build a residential structure that will meet more stringent building codes with requirements for axial compression, bending moment, shear standards to withstand the damaging forces of high wind conditions; plus meet the state's need to increase the energy-efficiency and quality of construction of housing in Mississippi; and enable the state to rebuild a significant volume of residential housing – structural insulated panels present a viable option.

The Stennis Institute began exploring the financial feasibility of utilizing SIPs by creating a financial model using the Waveland, Mississippi Housing Authority site as a model. Prior to this site being scoured of all residential structures by Hurricane Katrina, approximately 70 families occupied rental housing on this site. FEMA was proposing to provide 70 trailers, with a cost of $50,000 per unit to FEMA, at a total cost of approximately $3.5 million. The danger to the health and safety of citizens occupying mobile homes or trailers and the fiscal inefficiency of this policy deserves careful scrutiny. Although this solution may be expedient, it is incomprehensible. Unfortunately, FEMA will only provide funding for temporary housing and not for permanent housing under existing regulations. Now may be the time to revisit these regulatory guidelines and correct this shortsighted policy. Alternatively, other options may be examined such as the use of Low Income Housing Tax Credits.

Financing Housing

Low Income Housing Tax Credits (LIHTC) are a housing subsidy created within Section 42 of the Federal Tax Code. These tax credits can be used for new housing, only units that are occupied (rented or sold to) by persons/families with incomes at or below 60 percent of the local median income are eligible. Normally, the tax credit is taken over the first ten years of the project's operating period.

Although there are other considerations and regulatory requirement associated with LIHTC, the purpose of this document is to provide an overview, for simplicity the following are the critical elements of a LIHTC investment.

- **LOW-INCOME** housing projects are normally structured as limited partnerships that allow the general and limited partners to pass the tax credits through pro-rata to the partners themselves. Investor limited partners will pay a discounted net present value for the opportunity to reduce their future federal and/or state tax obligations. These investment structures are used to produce equity to finance the housing construction project.
- **WITHIN** the current market for LIHTC investors, the tax credit is normally sold for the discounted net present value of the credit – the current equity price is approximately $.95 to $.98 on the dollar for LIHTC.
- **A TAX** credit has value because it provides a dollar-for-dollar reduction in a taxpayer's federal and/or state income tax liability. One dollar of tax credit reduces the taxpayer's tax liability by an equivalent dollar.
- **MANY LIHTC** projects utilize both low-income

housing tax credits and tax losses which occur when a project's tax deductions (depreciation and amortization) exceed its taxable income – this provides a tax loss shelter for other income of the taxpayer upon which the taxpayer would be taxed.

» **TAX** credits are an excellent mechanism with which to attract investment from large corporations that have significant tax exposure (i.e. Exxon Mobil Corp., Chevron, Shell Oil USA, major corporations, banks, financial or investment corporations); banks may also receive CRA credit for this investment.

» **THE HURRICANE-IMPACTED** areas of Mississippi, specifically the Gulf Coast, proposed legislation at the Federal level is intended to make hurricane impacted areas eligible for a 130% step up in basis (boost)

Normally, LIHTC developments are undertaken by private developers who accrue the risk and returns related to the development of low-income housing. Another alternative is to establish public/private limited partnerships or limited liability corporations. These investment mechanisms are quite commonly used to achieve public purpose objectives and to attract equity investment into community development projects. Tax credit deals are complex and risky, professional management is required to assure proper property management and program compliance.

There are nationally recognized firms that provide program compliance accounting and legal services, utilization of these firms will facilitate that ability to attract national corporate and financial investors and to assure no recapture of the tax credit from investors. The services of a professional, experienced, creditable tax accounting firm is of significant importance when structuring tax credit investments. Normally, these investment consulting firms offer a full menu of services from which to select. Nationally recognized consulting firms offer a full range of consulting for low-income housing pre- and post-development services.

These services may include writing the proposal (Qualified Allocation Plan) for submission to the Mississippi HOME Corporation[28] to receive a Low Income Housing Tax Credit Allocation, selecting a developer or contractor, raising tax credit capital, audit, tax return, and lease testing services. These services may be anticipated to range from $35,000 to $100,000. The following fees are estimations for specific services, commonly rendered by nationally recognized consulting firms[29]:

Raising tax credit capital	**$35,000–$40,000**
10% test	**$3,500–$5,000**
Cost certification	**$10,000–$12,000**
Audit	**$10,000**
Tax return	**$3,500**
Lease testing	**~$45 per unit**

It is important to note that current regulations reduce the amount of the tax credit based upon the use of federal funds, tax-exempt bonds and other governmental sources of funding. In order for the state of Mississippi to meet the overwhelming need to replace housing destroyed by Hurricane Katrina a waiver of this regulatory obstacle may need to receive further examination and modification. Recently passed federal legislation will significantly increase the level of Low Income Housing Tax Credits available to Mississippi. With the expanded use of Low-Income Housing Tax Credits within Mississippi, special consideration should be given to the quality and type of housing that is built with these tax credits and the policies associated with the allocation, use, quality of construction, and appropriate valuation for property tax purposes to maximize public purpose objectives. Local assessors employ a wide range of valuation mechanisms and are experts in determining the best methodology for specific property. Specific appraisal mechanisms are already available that properly account for the net future value of income tied to the use of tax credits or similar funding opportunities that may represent the best methodology for these properties. Appraisal methods should always (a) use appropriate, defensible and sound appraisal tools; (b) reflect sound, standardized, and if appropriate, regionally adjusted input variables if they are necessary as a component of a particular appraisal mechanism (i.e. capitalization rate); and (c) ensure that the property is treated equitably in regard to other similarly classed properties.

Another option for funding new residential construction may be to discuss the feasibility of FEMA providing the equivalent dollar value of proposed expenditures for temporary mobile homes/trailers. Using the Waveland Project as an example, the ability to obtain $3.5 million in funding or any amount up to that value will augment the ability of communities to begin reconstruction. For example, "temporary" SIPs housing might be constructed and occupied by critical/necessary personnel such as teachers, medical and health care workers, public service, or other personnel critical to the redevelopment of the social fabric of devastated communities. At a subsequent, future point, when permanent housing is completed and ready for occupancy by critical/necessary personnel – the "temporary" SIPs housing could then be available for occupancy by low-income families/persons. Since the cost of construction and development of the "temporary" SIPs housing would have been paid by leveraging LIHTC – these housing units would have a zero balance owing. As a result, mortgages could be income based or could utilize the Section 8 Voucher to create homeownership opportunities for low-income persons. Due to occupancy and income requirements associated with low-income housing tax credits, this policy option may not be feasible without temporary modifications of eligibility requirements for

the receipt of LIHTC. Alternatively, low-income persons could immediately move into the housing upon completion of construction.

Feasibility dependent upon:

- **SIGNIFICANT** increase in Low Income Housing Tax Credits allocated to State of Mississippi
- **MODIFICATIONS** to existing FEMA regulations regarding "temporary" housing and policy of providing trailers only
- **MODIFICATION** of existing legislation to allow housing developments that receive federal supplements to receive a 9% LIHTC rather than current 4% limit – this should be for hurricane impacted areas only to attract investment into housing redevelopment
- **RECEIPT** of 2006 Forward Commitment Tax Credit Allocation from Mississippi Home Corporation

Housing Design, Materials, Construction

- **ENSURE** designs are compliant with new Building & Zoning standards
- **ENSURE** designs are sufficient to withstand hurricane force winds of approximately 150 to 200 m.p.h.
- **ENSURE** design flexibility by the inclusion of additional elevated designs and foundations (other than concrete)
- **UPDATE** cost estimates to include steel SIPs
- **REMEMBER** that production of SIPs panels need 3 to 6 weeks lead time
- **REQUEST** assistance from panel manufacturers to provide on-site technical training for contractors/construction workers

Financing

- **CONSIDER** structuring non-profit/for-profit limited partnership
- **SECURE** forward commitment for tax credit allocation
- **SECURE** tax credit investors

Conclusion

The intent of this paper is not to suggest that the use of structural insulated panels is the sole solution for meeting Mississippi's housing crisis. Rather it is proposed within the framework of offering a high-quality, safe, energy-efficient home that provides a solution to reduce the inequitable burden that energy costs impose upon the low-income citizens in the state of Mississippi; creating opportunities for homeownership for low-income families with all of the positive societal benefits that homeownership conveys; reducing the negative economic outflow of dollars from the state's economy associated with energy expenditures; integrating the efficiencies and costs savings of the economies of scale associated with the manufactured elements of the building inputs; and offering the ability to expedite the speed with which the housing needs of the state are met.

The positive public policy implications of transferring the financial benefits of low income housing tax credits and utilizing these benefits to meet the needs of low-income families by structuring local or statewide organizations to invest in the development of high-quality low-income housing and assuring that the full benefit of the revenue stream associated with these developments accrue to the benefit of the community and the families within these communities by providing pre-school and after-school educational programs or meeting the needs of elderly residents should be fully considered. Simply stated, this approach enables the private sector to retain the financial benefit of tax credits and assures that these benefits are used to address important societal needs in Mississippi.

End Notes

[1] U.S. Household Energy Report, Energy Information Administration, release July 2005.
[2] Ibid.
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[4] Energy Information Adminstration, State Energy Data 2001: Prices and Expenditures
[5] The Cold Facts: The First Annual Report on the Effect of Home Energy Costs on Low-Income Americans (2005), Dr. Meg Powers
[6] Ibid.
[7] Ibid.
[8] U.S. Department of Health & Human Services, http://www.acf.hhs.gov/news/press/2005/LIHEAP_2005.htm
[9] *The Hidden Link: Energy and Economic Development*, The Energy Task Force of Public Technology, U.S. Department of Housing & Urban Development, 1987.
[10] Ibid.
[11] U.S. Bureau of the Census, State and Metropolitan Area

Data Book 1997, – 98, Table A-20.

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[17] U.S. Census Bureau, 2000.

[18] Galster, G., "*Empirical Evidence on Cross-Tenure Differences in Home Maintenance and Conditions,*" **Land Economics**, 59 (11983) #1: 107 – 113.

[19] DiPasquale, D., and E. Glaeser, "*Incentives and Social Capital: Are Homeowners Better Citizens?*:" **Journal of Urban Economics**, 45 (11999) #45:354 – 384.

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[21] HUD publication: "*Economic Benefits of Increasing Minority Homeownership*" reference U. S. Census Bureau, Characteristics of Business Owners, U. S. GPO, Washington, D.C. September 1997.

[22] Oak Ridge National Laboratory, Advanced Wall Systems, http://www.ornl.gov/sci/roofs+walls/AWT/Hotbox-Test/SIPs/SIPA/index.htm.

[23] *A New Whole Wall R-value Calculator, An Integral Part of the Interactive Internet-Based Building Envelope Materials Database for Whole-Building Energy Simulation Programs,"* Jan Kosny, Ph.D. Oak Ridge National Laboratories Building Technology Center.

[24] For more in-depth information, the interested reader may examine the findings of Oak Ridge Laboratories online at http://www.ornl.gov/sci/roofs+walls/AWT/Ref/Home.htm or contact Dr. Jan Kosny at 865-574-9353.

[25] U.S. Department of Housing & Urban Development , Partnership for Advanced Housing Technologies, http://www.toolbase.org/techinv/techDetails.aspx?technologyID=114.

[26] University of Florida, *Performance Under Pressure: Structural Insulated Panel (SIP) Walls*, http://www.energy.ufl.edu/instructors/SIP_Wall_HomeFront_Final2005-05-04.pdf

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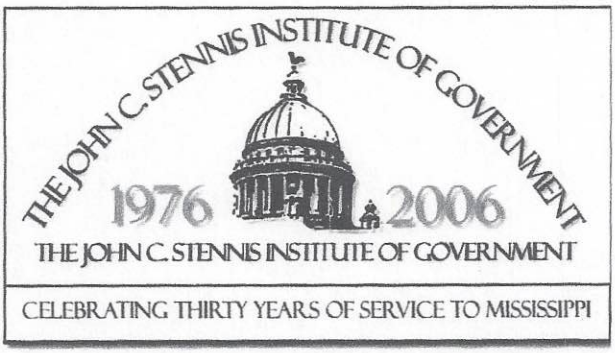
[30] Oak Ridge National Laboratories, Dr. Jan Kosny.



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