PARTNERSHIP FOR ADVANCING TECHNOLOGY IN HOUSING

Partnership for Advancing Technology in Housing (PATH):

Strategy and Operating Plan

July 24, 2000

PD&R
Office of Policy Development and Research

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Acknowledgements

This Report was prepared by the Office of Policy Development and Research under the technical direction of David Engel (PD&R) and Elizabeth Burdock (PATH). PD&R acknowledges the contributions of Rick Nevin, Andrew Zehe, Heather Gazan, Scott Ledford, Stephanie Carnes, Rinku Shah, and Ashley Lare, all of ICF Consulting, and members of the Federal Agency Working Group, including John Talbott (DOE), David Lee (EPA), Joel Zingeser (NIST), Diane Dorius (FHLFB) and David Thomas (FEMA).

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PARTNERSHIP FOR ADVANCING TECHNOLOGY IN HOUSING (PATH) STRATEGY

The Partnership for Advancing Technology in Housing (PATH) is a public/private initiative designed to dramatically improve the quality, durability, energy efficiency, environmental performance and affordability of our Nation's housing by accelerating the creation and widespread use of advanced technologies in the housing industry.

PATH Goals

When President Clinton launched the PATH program in 1998, he charged PATH with developing technologies, housing components, designs and production methods that will reduce by 50 percent the time needed to move quality technologies to market, by the year 2010. As a result, by 2010 these new technologies will make it possible to:

- Reduce the monthly cost of new housing by 20 percent or more;
- Cut the environmental impact and energy use of *new housing* by 50 percent or more and reduce energy use in at least 15 million *existing homes* by 30 percent or more;
- Improve durability and reduce maintenance costs by 50 percent; and
- Reduce by at least 10 percent the risk of loss of life, injury and property destruction from natural hazards and reduce by at least 20 percent residential construction work illness and injuries.

Emerging technologies that could shape and advance the housing industry are all too often not readily accepted. This is because this industry, unlike other major engines of the economy, is extremely dispersed, consisting of hundreds of thousands of separate companies. To introduce a new technology into this market place, let alone achieve any significant market penetration, is a time consuming and costly process - one that discourages most attempts at true innovation and slows down those that get past the prototype stage. Typically, it can take 10 to 25 years for a new housing product or technique to achieve full market penetration. The slow rate of market acceptance for new housing technologies extends the payback period for housing research and development investments. This is a key factor in the housing industry's low rate of R&D investment (2.7% of total revenue) relative to other industries.

PATH is a true partnership between the federal government and industry. PATH will accelerate the rate of market acceptance of new technologies through industry-defined efforts and strategies directed at research, technical support, information dissemination, regulatory streamlining, consumer awareness, and financial incentives. In concert with the needs identified by industry, PATH leads a coordinated government effort to increase Federal support for housing research, development and demonstration programs. By closing these gaps and getting the next generation of housing technologies into the market faster, PATH will have a significant impact on the overall performance and affordability of America's housing.

PATH Strategy and Operating Plan

This report presents the strategy for meeting the PATH program goals for the year 2010. This is the second such report submitted to Congress. In February 1999, HUD submitted its initial plan to Congress. That report was prepared in response to language in the Conference Report (Report 105-769) accompanying the Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriation Act of 1999. The conferees directed HUD "to furnish the VA, HUD and Independent Agencies subcommittees with an operating plan for PATH, including specific and measurable goals, no later than December 31, 1998, and a draft evaluation report describing progress made toward meeting those goals no later than April 30, 1999." The first PATH Operating Plan (February 21, 1999) described the roles and activities of key PATH partners under category headings for each of the PATH goals. This organizing principle was an important first step in identifying and coordinating the diverse public and private efforts related to PATH. A follow-up progress report was submitted to Congress on April 22, 1999.

House Committee language accompanying the 2000 VA, HUD and Independent Agencies Appropriations Act requested that HUD submit a second PATH Operating Plan. The Committee also directed HUD to cooperate fully with the home building industry and particularly, the National Association of Home Builders Research Center which "shall coordinate industry participation and research planning for the Partnership." The Committee also directed that no PATH funds be used for duplicative agency activities and that the Operating Plan include an explanation of how the technology and research activities of other agencies support PATH operations and goals.

Comments on the first PATH operating plan observed that the overall PATH strategy to meet the goals by 2010 was less than clear and obscured by the large number of short and long-term actions included in the Report. To address this concern, this Report to Congress has two separate components: a PATH Strategy and a PATH Operating Plan (Attachment B). The Strategy presents a roadmap for PATH activities. The Operating Plan, following the structure of the Strategy, details the specific activities that are underway.

The 1999 PATH Operating Plan (Attachment C) organized all activities by PATH goal, but this format obscured important synergies that PATH can achieve by developing and deploying housing technologies that simultaneously address several different PATH goals. Therefore, the PATH Strategy presented here identifies 12 strategic initiatives under the following objectives:

- Technology needs assessment
- Technology development
- Technology adoption
- Resource coordination

These strategic initiatives cut across the PATH goals and help to clarify how the roles and activities of PATH partners relate to one another and to the overall strategy.

Organization of this Document

The balance of this Report is divided into 3 sections:

I. PATH Organizational Structure and Partner Roles and Responsibilities
II. PATH Strategic Initiatives
III. PATH Baseline, Interim Objectives, and Performance Measures

Section I describes the activities of the PATH Program Office, the Committees and Working Groups that have been established to achieve the PATH Goals, and the PATH-related research and program activities of Federal PATH partners. PATH has established six Working Groups, comprised of government and private sector representatives, to coordinate public and private efforts to conduct housing technology research and development work and accelerate market acceptance and deployment of advanced housing technologies. Many Agencies and Departments of the Federal government also have ongoing program and research initiatives related to PATH, and Section I provides background on these PATH-related initiatives. Federal partners will continue to pursue their separate missions related to PATH, and key partners have been assigned the lead responsibility for specific PATH goals. However, a cornerstone of the PATH strategy is that all PATH partners, in meeting their program responsibilities, will also move beyond single objectives to address multiple PATH goals.

Section II describes 12 initiatives that, if fully implemented, can achieve PATH goals by 2010. These strategic initiatives are the heart of the PATH strategy, addressing technology needs assessment, development, adoption, and resource coordination. Essential to implementing the Strategy is the appropriate coordination and integration of activities relating to each strategic initiative including research, development, deployment, and information dissemination. Section II also describes the purpose of each strategic initiative and how it relates to meeting the PATH goals, highlights some of the current PATH activities related to each initiative, and introduces some of the important roles played by specific PATH partners and Working Groups (introduced in Section I). An overview of the PATH strategy is presented at the beginning of Section II, including a diagram that characterizes the dynamic relationship between the PATH strategic initiatives, to provide context for the subsequent descriptions of each strategic initiative.

Section III explains the specific criteria that will be used to quantify the baseline for the PATH Goals, and the data sources and performance measures used to assess progress toward achieving those goals. This Section also establishes interim objectives for the PATH program to achieve in each year in order to achieve its mission goals for the year 2010.

I: Organizational Structure and Partner Roles and Responsibilities

This section describes the organizational structure for the PATH initiative and introduces some of the important PATH-related activities of specific PATH partners. PATH partners discussed in this section play key roles in implementing the strategic initiatives discussed in Section II. Private sector members of PATH include representatives of builders, remodelers, developers, housing manufacturers, product manufacturers, financial and insurance organizations, retailers and distributors, university and research laboratories, utilities, and labor organizations. These private sector PATH partners work with staff from Federal agencies and departments through a number of Working Groups and committees formed by the PATH Program Office. State and local governments and non-profits will be increasingly involved as PATH proceeds to establish local and regional public/private partnerships.

This section of the Strategy is not intended to provide a complete accounting of PATH partners and activities. The accompanying PATH Operating plan is organized to closely follow the format of the Strategy and presents a far more complete and detailed description of all PATH activities. Also, a complete list of PATH private and public partners is available from the PATH web site (**www.pathnet.org**) and will be updated as more public and private partners join the PATH effort over time.

The remainder of this Section describes the PATH organizational roles and responsibilities and key PATH-related activities of the following entities:

- PATH Program Office
- Industry Steering Committee
- Public/Private PATH Working Groups
  - Technology Working Group
  - Barriers/Insurance Working Group
  - Quality Working Group
  - Labor Working Group
  - Finance Working Group
  - Consumer Education Working Group
- Federal Agency Working Group
  - Department of Housing and Urban Development (HUD)
  - Department of Energy (DOE)
  - Environmental Protection Agency (EPA)
  - Department of Commerce, National Institute of Standards and Technology (NIST)
  - Department of Agriculture, Forest Products Lab (FPL)
  - Department of Labor, Occupational Safety and Health Administration (OSHA)
  - Federal Emergency Management Agency (FEMA)
  - National Science Foundation (NSF)
  - Federal Home Loan Finance Board (FHLFB)
  - Department of Defense (DOD)
  - Department of Interior (DOI)

- Oversight and Assessment (National Academy of Sciences/ National Research Council)

The PATH Program Office

The PATH Office is funded by HUD and staffed by employees detailed from a variety of Federal agencies and departments working under the direction of the PATH Executive Director. The PATH Office facilitates interagency housing technology research planning and dissemination efforts. The PATH office serves as the program liaison and major point of contact with industry and the general public. The PATH Office also manages and organizes education and information dissemination programs and coordinates issue-based working groups. HUD is responsible for managing and providing technical direction for PATH contracts, grants, cooperative agreements and other research efforts.

Industry Steering Committee

To ensure a leading voice for the private sector in the PATH initiative, an Industry Steering Committee composed of builders and product manufacturers has been established. This Committee is staffed by the National Association of Home Builders Research Center (NAHBRC) in fulfillment of the direction from Congress that the NAHBRC coordinate industry participation and research planning for PATH. This Committee plays a key role in identifying gaps in advanced housing technology and recommending priorities in support of industry and government research. A listing of Steering Committee members is provided in Attachment A.

Public/Private PATH Working Groups

Six Working Groups comprised of government and private sector representatives coordinate public and private efforts to conduct housing technology research and development work and accelerate market acceptance and deployment of advanced housing technologies. A listing of current members of the groups is provided in Attachment A. Each Group is co-chaired by a representative from each sector.

The Working Groups have the following overall goals:

- To identify issues and barriers to advanced housing technology dissemination
- To develop strategies to overcome barriers to advanced housing technology dissemination
- To develop strategies to meet PATH goals.

Technology Working Group

The mission of the Technology Working Group is the most important in achieving the PATH goals. This Group works with the Industry Steering Committee to develop a technology research plan and to stimulate public and private research investments to develop advanced housing technologies that will meet the PATH goals. A formal roadmapping process is being

conducted to establish research priorities and create technology development tactics and timelines for specific housing components and housing systems as well as industry segments.

Barriers/Insurance Working Group

The Barriers/Insurance Working Group addresses regulatory barriers including building codes, evaluation systems, product liability, and homeowner's property insurance issues. Initially, the Group has examined how the insurance industry can factor in the value of advanced housing technologies to set rates that provide incentives for using PATH-evaluated technologies. This Group is also examining the need for and design of a program that will permit builders' insurance companies to fully cover all risk inherent in the deployment of new technologies (at a reasonable rate to the builder). It is also considering programs that will reassure builders that manufacturers will honor their warranties. The Group will also assess codes as possible barriers to innovation.

Quality Working Group

The Quality Working Group facilitates quality assurance procedures that lead to reductions in code inspections and builder callbacks, which ultimately lead to increased durability and affordability. This Group expects to assist in the development of quality standards that will lead to insurance and mortgage incentives; and to coordinate quality assurance procedures for builders, trade contractors, product manufacturers, and code officials. It will also examine ways that the construction process can be reengineered to improve quality and affordability, train the workforce to ensure quality construction and implementation of advanced housing technologies, and promote customer-focused business practices that increase consumer satisfaction.

Labor Working Group

The mission of the Labor Working Group is to examine labor supply, training issues and worker safety procedures. A major opportunity is to help manufacturers develop and builders use products that require less skilled labor.

Finance Working Group

The Finance Working Group is currently exploring why energy efficient mortgages are not widely used and how lower insurance, operating, and maintenance costs of homes with PATH-evaluated technologies can be taken into account when underwriting home purchase or rehabilitation loans. This group will also examine housing appraisals and identify methods to communicate to appraisers the full value of PATH-evaluated technologies in housing. They will also identify demonstrations and pilot programs to explore the use of finance methods, create a strategy for explaining these financing options to lenders and consumers; and provide financing recommendations to private, state and federal government programs that could facilitate reaching PATH goals.

Consumer Education Working Group

The Consumer Education Working Group is examining the five phases of technology adoption – awareness, interest, evaluation, trial, and adoption. Based on this examination, they will propose strategies that encourage rapid market acceptance of new housing technologies, educate builders and remodeling contractors about new technologies, and teach home builders and homeowners how to identify and demand superior housing technologies.

Federal Agency Work Group

The PATH Office facilitates the coordination of Federal resources and strategies through the Federal Agency Work Group (FAWG), and has identified the specific agencies and departments with leadership roles for elements of the PATH overall program:

- **Affordability**: U.S. Department of Housing and Urban Development (HUD)
- **New Home Energy Efficiency**: U.S. Department of Energy (DOE) and the Environmental Protection Agency (EPA)
- **Existing Home Energy Efficiency:** EPA, DOE
- **Durability:** HUD, National Institute of Standards and Technology (NIST) and U.S. Department of Agriculture Forest Products Lab (USDA FPL)
- **Disaster Resistance**: Federal Emergency Management Agency (FEMA)
- **Safety**: Occupational Safety and Health Administration (OSHA)

The agency, that takes the lead responsibility for a PATH element works with other participating agencies to develop appropriate multi-agency strategies. The very nature of PATH also requires that each agency, in meeting its program responsibilities, move beyond single objectives to address multiple goals including affordability. To ensure that this is accomplished, the agencies and departments with leadership responsibilities for individual PATH goals will work with the PATH Office to ensure that the annual PATH operating plan activities are consistent with achieving all of the PATH goals. Each of these agencies and departments will also identify under-utilized technologies and help to assess the potential of new technologies related to the PATH goal for which they have lead responsibility.

In addition to assumed leadership for specific PATH goals, all public PATH partners have also committed themselves to coordinating their research and program activities to achieve all of the PATH goals. The following Federal agencies and departments have ongoing research and program activities that are especially important to the PATH initiative, and will work to coordinate their programs and initiatives to support PATH goals.

Department of Housing and Urban Development (HUD)

Because PATH is directed at changing the housing industry, the Administration and Congress have asked the Department of Housing and Urban Development to manage the PATH effort. HUD and DOE (because of its large technology research budget and expertise in energy

efficiency issues and in building research and development) are co-leads for setting general PATH policy. HUD is charged with day-to-day management and coordination of PATH and management of PATH contracts and cooperative agreements. All activities identified as PATH in this report are, unless otherwise noted, supported by HUD appropriations.

Policy Development and Research (PD&R)

In addition to supporting PATH, HUD's Office of Policy Development and Research (PD&R) undertakes its own research and related regulatory and policy analysis to reduce the cost of producing, rehabilitating and operating a home or dwelling. Activities include research into new and innovative technologies and construction methods; reform of codes, standards and product evaluation and acceptance systems; and developing methods to accelerate technological transfer and acceptance of innovation. PD&R also works to eliminate or reform duplicative or excessive regulatory requirements that raise the cost of both private market and publicly assisted housing.

In a cooperative agreement with the NAHBRC, PD&R is currently reviewing technologies that can provide cost-effective alternatives to wood in home construction, investigating insulated concrete forms, concrete block and steel-framing. In the area of rehabilitating existing housing, PD&R is working with model code organizations to eliminate many of the regulatory barriers to rehabilitation, and developing a series of guides for using new technologies in rehabilitation. PD&R is also developing plans with industry for a "next generation" manufactured home which will address many of the PATH goals.

PD&R also conducts research to improve the substance and administration of departmental standards and requirements affecting structures and land development, including HUD Minimum Property Standards, Section 8 Housing Quality Standards, and HUD Manufactured Housing Construction and Safety Standards. It also sponsors research to assure that the interests of consumers, especially the elderly and disabled, are adequately and cost-effectively considered in the construction and rehabilitation of housing.

HUD Operating Programs

HUD's Operating Programs can be a major resource in commercializing new technologies and can assure that these technologies benefit lower and moderate-income families. HUD's programs provide subsidies and/or insurance for a wide range of programs that result in new or rehabilitated housing. The Office of Housing plays a key role through FHA insurance and the Manufactured Housing Program, which directly regulates the construction of the more than 350,000 manufactured housing units (mobile homes) produced annually in the United States. FHA also plays an integral part in providing financial incentives such as energy efficient mortgages that facilitate the adoption of advanced housing technologies. Changes to HUD's underwriting requirements or manufactured housing standards can accelerate adoption of PATH technologies.

Other HUD operating programs (public housing, Section 8 assistance, Community Development Block Grants (CDBG), and HOME) provide additional venues for developing housing with advanced technologies for low-income persons. HUD's "technical suitability of products" program evaluates new and innovative building systems and products for the builders of these housing developments. Under the PATH Strategy and Operating Plan, HUD will be reviewing the regulations and policies of all these programs to ensure that they support the PATH goals and take advantage of PATH generated research.

Finally, the National Partners in Homeownership Initiative seeks to lift the homeownership rate to an all-time high. Sixty-seven national private and public organizations are members of the Partnership including: National Association of Home Builders, Manufactured Housing Institute, Fannie Mae, American Institute of Architects, Council of American Building Officials, and the Mortgage Bankers Association. As part of their efforts, the Partners have committed to working on "a public-private effort to accelerate adoption of technological innovation in the homebuilding industry."

Department of Energy (DOE)

As the Agency with the largest building technology research budget, DOE supports a variety of PATH-related activities. Working with industry, DOE develops, promotes, and integrates energy technologies and practices to make buildings more energy efficient. DOE works to accelerate the introduction of highly efficient technologies and practices through research and development and the Energy Star Program (a joint DOE-EPA program). DOE also increases the minimum efficiency of buildings and equipment through codes, standards, and guidelines, and encourages the use of energy efficiency and renewable energy technologies and practices through technology transfer and financial assistance. Specifically, the Department has responsibility to promote the adoption of energy efficiency codes and provides training in this area for building code officials and homebuilders. In addition, the Department issues appliance standards on major residential components such as refrigerators, central air, lighting ballast and washing machines.

Building America

The DOE Building America program's goal is to produce homes that use 30% to 50% less energy and reduce construction time and waste by as much as 50%. Building America also seeks to improve builder productivity, provide new product opportunities to manufacturers and suppliers, and implement innovative energy- and material-saving technologies.

Utilizing a systems-engineering approach to construction, Building America forms teams of architects, engineers, builders, equipment manufacturers, material suppliers, community planners, mortgage lenders, and contractor trades. Currently, there are four teams comprised of more than 50 different companies. Using the systems engineering approach, Building America team partners agree to evaluate their design, business, and construction practices to identify cost savings and re-invest cost savings in improved energy performance and product quality. Several hundred homes have been completed, and plans are in place to build several thousand more. A related program, "Rebuild America" focuses on rehabilitation and,

through an Interagency Agreement with HUD, is helping public housing authorities take action to reduce utility costs by using energy efficient appliances, heating and cooling systems, and lighting. As data becomes available from both Building America and Rebuild America, PATH will actively disseminate results to the building industry.

DOE Research and Advanced Energy Technology Programs

DOE - funded research produces advances in lighting, windows, insulation, building materials, appliances, weatherization, and whole-building design. For example, DOE researchers, in partnership with industry, have developed a 20-cubic-foot refrigerator-freezer that uses only 1.04 kilowatt-hours of electricity per day, half the current standard. DOE's Solar and Renewable Energy Program includes the President's Million Solar Roofs initiative with a goal to place 1 million solar energy systems on U.S. buildings by 2010. Building engineers and architects are also using DOE-developed software design tools to increase the efficiency and lower the environmental impact of new and retrofitted construction. Computerized modeling tools such as "Designing Low Energy Buildings" and "DOE-2" help designers integrate energy-efficient and renewable-energy components and systems into building plans at the blueprint stage. DOE has also consolidated its "Distributed Energy Resources" into a major initiative to take advantage of waste heat and integrated energy production.

DOE Operating Programs

The Weatherization Assistance Program is a major tool for PATH in meeting the existing home goal. The need for weatherization is acute in homes occupied by lower income families. Families on welfare pay an average of 26% of their income on energy costs. The DOE Weatherization program is the largest program targeting low-income housing for weatherization. The program has already performed retrofits of energy saving measures in over 4.7 million homes of low-income families in all 50 states and seven territories. Currently, DOE funding supports weatherization of about 70,000 homes per year.

Under another program, State energy offices receive annual funding to support and promote energy efficiency and renewable energy activities such as outreach to their building industries, deployment of new technologies, energy efficient building codes, home energy audits and public information, community workshops, and ENERGY STAR promotion. (The ENERGY STAR program is discussed in more detail under the description of EPA activities.)

United States Department of Agriculture Forest Products Lab (FPL)

The Forest Service's Forest Products Laboratory (FPL) is the nation's leading wood research institute. Its research includes housing and structural uses of wood, wood preservation, wood and fungi identification, and the finishing and restoration of wood products. In addition to traditional lines of research, FPL responds to environmental pressures on the forest resource by developing new recycling technologies and other environmentally friendly technologies. A multi-year inter-agency agreement between PATH and FPL calls for the development of a

national durability conference (held in November 1999) and implementation of three residential construction research projects over the next four years. These FPL-PATH research projects are designed to develop:

- Improved design and quality of wood frame houses subjected to high winds and severe storms;
- A grading standard for recovered lumber from existing buildings to increase its marketability and reuse by the construction industry; and
- Greater understanding of the susceptibility of wood products to decay when subjected to repeated wetting and drying.

Department of Commerce, National Institute of Standards and Technology (NIST)

The National Institute of Standards and Technology (NIST) Building and Fire Research Lab enhances public safety and the competitiveness of U.S. industry by developing performance prediction methods, measurement technologies, and technical advances needed to assure the life cycle and economy of constructed facilities. Its products are used by those who own, design, construct, supply or provide for the usefulness, economy, safety or environmental quality of constructed facilities. NIST studies building materials; computer-integrated construction practices; fire science and fire safety engineering; and structural, mechanical, and environmental engineering.

NIST, with industry, has initiated the Performance Standards System for Housing (PSSH) program to develop national and international performance standards that hasten the development, evaluation and acceptance of innovative housing products and systems. This effort is focused on identifying and conducting high priority research projects related to one- and two-family homes. Included in this effort is research into the structural performance of housing and developing ways to predict and evaluate the performance of single family dwellings built with traditional and non-traditional construction materials. The "Next Generation Design Standard for Wind Loads" project is assembling data for an improved standard for improved wind-resistant dwellings. NIST, with PATH funding, is leading the PATH Cooperative Research Program (PATHCorp), a series of research and development projects, led by industry, each aimed at one or more PATH goals.

Indoor Atmosphere research activities at NIST focus on data collection and modeling related to measurements needed for new housing and building contaminants and ventilation rates. In a joint PATH/NIST funded program, new cost-effective methods for improving fire safety in existing housing are being studied. Durability research, funded by PATH, is aimed at enhanced methods for measuring and predicting the service-life performance of key housing components such as sealents and roofing materials. Other research is developing software tools for decision-making that incorporate a standard methodology for designing buildings to achieve the most appropriate balance among life-cycle environmental, economic and technical performance.

Department of Labor (DOL)

The Department of Labor's Occupational Safety and Health Administration (OSHA) promotes and enforces workplace safety and health. Efforts to reduce injuries and illnesses not only avert pain and disability for workers, but also save builders money, making housing more affordable. Worker's compensation costs are about $5,000 per unit or 30 percent of payroll for builders of single-family housing, according to the National Institute for Occupational Safety and Health (need citation). To combat this toll, OSHA has awarded grants to groups such as the National Association of Home Builders, the National Safety Council, and the Occupational Health Foundation on behalf of AFL-CIO Building and Construction Trades to develop and provide safety training to contractors and workers. In addition, OSHA is working with residential builders' associations to encourage partnerships and other cooperative efforts with builders to promote safe work practices and effective safety and health programs.

Environmental Protection Agency (EPA)

The Environmental Protection Agency has instituted numerous programs to advance building technologies that improve energy efficiency, offer economical housing options, improve indoor air quality, or reduce pollution.

ENERGY STAR Programs

The EPA/DOE's voluntary, market-based ENERGY STAR programs aim to promote products that use less energy than other products, save money on utility bills, and help to protect the environment. The ENERGY STAR label can be found on household appliances, home electronics, office equipment, windows, lighting fixtures, HVAC equipment and even homes. The ENERGY STAR Homes Program focuses on working with builders, utilities, and industry to develop the market for and construction of homes that are at least 30% more efficient than the national Model Energy Code. The means to achieve these high performance homes include improved insulation, advanced windows, tightly sealed ducts, high-efficiency heating and cooling and reduced air infiltration. The program benefits builders as they experience increased profits, more satisfied customers, fewer call-backs, and more referrals, all while offering a better, more energy efficient product. The benefits to homeowners include improved comfort, air quality, and construction quality along with lower utility bills and higher resale values. EPA, with DOE, is currently developing an ENERGY STAR Program for retrofitting existing homes. As discussed subsequently, this new program will be a major vehicle for PATH to meet its existing home energy goals.

Other PATH-Related EPA Programs

Several other EPA programs can impact the PATH initiative. The Radon-Resistant New Construction Program develops and promotes model standards and building techniques that significantly reduce the risk of radon contamination. The Construction Research Program concentrates on methods to reduce construction waste and to recycle building materials. The Green Builder Program promotes building practices that conserve energy, water, and other

natural resources while strengthening the local economy and preserving the environment. Finally, the Indoor Environments Program develops and disseminates information, guidance, and solution-based technologies on indoor air quality.

Federal Emergency Management Agency (FEMA)

FEMA provides leadership and support for the nation's emergency management system so that States, local governments, and others can effectively prepare for, respond to, recover from, and mitigate the effects of natural disasters. FEMA is interested in helping people and communities build safer and stronger buildings, strengthen existing infrastructure, facilitate the development and adoption of hazard-resistant building codes and ordinances, and plan for future development so they are better protected from hazards of all types. The following FEMA programs can contribute to the PATH effort.

- Project Impact: This is the Agency's priority initiative. It provides technical assistance and seed funding to selected communities to help them identify their risks, develop local priorities on how to address that risk, and initiate measures that will help them become more disaster resistant.

- National Earthquake Program: The National Earthquake Program promotes research in order to develop data, resource information, and training materials for designers, regulators, and standards writing organizations to improve the ability of new and existing buildings to withstand earthquakes.

- National Flood Insurance Program: This program supports local and State floodplain management activities, and makes available flood insurance in communities that adopt and enforce floodplain management ordinances that meet minimum standards.

- Hazard Mitigation Grant Program: After the issuance of a Presidential disaster declaration, FEMA grants may be available within a state for implementation of cost-effective projects that will reduce the risk of future disaster damages.

- U.S. Fire Administration: The US Fire Administration collects data, conducts research and provides training and education on fire prevention and control.

National Science Foundation (NSF)

The National Science Foundation advances fundamental engineering knowledge and supports PATH-related construction, materials and systems research at universities and in partnership with industry. NSF cluster research programs that benefit PATH include geotechnology/structures research, mechanical/materials research; and research on hazard reduction programs. Using NSF and PATH funding, NSF has issued a nation-wide grant solicitation to universities and colleges for applications for fundamental research to support PATH goals. PATH anticipates providing additional matching funding to continue this research initiative in future years. In FY2000, eleven awards are being announced in late spring 2000.

Federal Home Loan Finance Board (FHLFB)

The Federal Housing Finance Board ensures the safety and soundness of the Federal Home Loan Banks, their access to capital markets, and the accomplishment of the congressional defined housing finance mission. The Federal Home Loan Bank System provides access to housing for all Americans and to improve the quality of their communities by extending credit through its more than 7,400 member financial institutions. The Banks are government chartered member-owned corporations regulated by the Federal Housing Finance Board. Since 1989, the Federal Home Loan Bank System's public policy mission has been expanded to include Affordable Housing and Community Development lending. The Federal Home Loan Finance Board is involved in PATHs Finance Working Group.

Department of Defense (DOD)

The Department of Defense's Office of Economic Adjustment (OEA) is responsible for planning and managing DOD's defense economic adjustment programs and assisting state and local officials in cooperative efforts to avoid detrimental side effects from military realignments and facility closures. All of the assistance is directed to States and/or local governments to facilitate planning for military base closures or realignments.

Discussions have been entered into between the PATH office and the Deputy Under Secretary of Defense for Installations' office about partnership with PATH for the rehabilitation and privatization of base housing. In addition, the PATH program is in discussions with several former military base reuse authorities under the Base Realignment and Closure process about working with the PATH program for housing development associated with base closures. PATH is working with the Department of Defense to incorporate the PATH goals into military housing specifications and to encourage the reuse or recycling of materials in housing deconstruction.

Department of Interior (DOI)

The Department of Interior (DOI) is responsible for the management of federally owned lands and resources, including National Parks and Monuments and Indian Lands. Several DOI programs may be integrated into the PATH National Pilot Sites developments, including:

- The Urban Park and Recreation Recovery Program: This program provides project grants to cities and counties meeting certain requirements based on need, economic and physical distress and the quality and condition of urban recreation facilities. PATH National Pilot Sites could access these funds through partnership with municipalities.

- Earthquake Hazards Reduction Program: This program is operated under the U.S. Geological Survey and provides grants to evaluate regional and urban earthquake hazards, including projects for earthquake-loss reduction. The program could assist in the evaluation, development, and use of housing materials and construction practices to protect against damage and loss from earthquakes.

Oversight and Assessment (National Academy of Sciences /National Research Council)

The National Academy of Sciences (NAS) is a private, non-profit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of further knowledge and advising the federal government. The National Research Council is administered jointly by both Academies and the Institute of Medicine.

As HUD believes that the PATH evaluation effort would be enhanced through a multi-year oversight and assessment process carried out by an independent review body, NAS will review and assess PATH's performance in achieving its multiple program objectives to expand the development and utilization of new technologies in the American housing industry. To determine how well PATH is performing, NAS will review the framework for evaluating performance and specific performance measures discussed in Section III of this document. Information will be collected and tracked by PATH contractors with independent oversight by NAS. Adjustments will be made based on NAS recommendations approved by Assistant Secretaries at HUD and PATH designees at the White House.

NAS, with staff support from PATH contractors, will also review strategy implementation tactics that PATH will further develop during FY2001. These include (1) implementation tactics for coordinating existing home rehabilitation, lead hazard reduction, and weatherization efforts to achieve the PATH existing home goal; and (2) the development of more specific feedback mechanisms to inform PATH about its early and ongoing progress.

II. PATH Strategic Initiatives

The PATH Strategy is organized around 12 initiatives addressing technology needs assessment, development, adoption, and resource coordination that, if fully implemented, can achieve PATH goals by 2010. Essential to implementing the Strategy is the appropriate coordination and integration of activities relating to all 12 strategic initiatives including research, development, deployment, and information dissemination. For PATH to successfully meet the goals that have been established, close cooperation among PATH federal partners must continue and, in fact, be expanded to include long-term cooperative research planning. Expanded cooperative research between industry and government is also an essential element of the PATH plan. Clearly, adequate resources and commitment for long and short-term research and deployment must also support the plan. Finally, the PATH plan assumes relative stability in the economic environment regarding housing starts, interest rates and other key economic indicators.

The PATH strategy consists of the following strategic initiatives designed to achieve the PATH goals:

Technology Needs Assessment

S1. Identify cost-effective technologies that will further PATH goals but are under-utilized.

S2. Identify technologies with demonstrated technical potential for furthering PATH goals but limited market share, and evaluate potential for achieving broader market acceptance.

S3. Identify research gaps in advanced housing technology development to set priorities in support of industry and government research and development that will further PATH goals.

Technology Development

S4. Encourage basic research and testing of new housing technologies through better coordination and documentation of government, university, and industry research.

S5. Assist in the development and testing of new technologies that contribute to meeting the PATH goals.

S6. Facilitate communication and partnering agreements between housing technology innovators, housing component manufacturers, and builders to accelerate the development of new technologies.

Technology Adoption

S7. Promote the use of advanced housing technologies that further PATH goals in "real life" housing developments to familiarize builders with innovations, capture installation, cost and performance data, and gain consumer feedback.

S8. Develop and maintain a communication infrastructure that provides reliable, useful information to the consumer, builder, and other key stakeholders regarding the use and acceptance of advanced housing technologies.

S9. Identify institutional barriers to housing technology deployment and provide solutions.

S10. Integrate the use of advanced housing technologies in specific federal housing programs, and develop local and regional public/private PATH partnerships.

Resource Coordination

S11. Coordinate government program efforts to work more effectively with each other and the housing industry to create outcomes that are more than the sum of individual efforts.

S12. Coordinate efforts to leverage public and private resources for achieving the PATH goals.

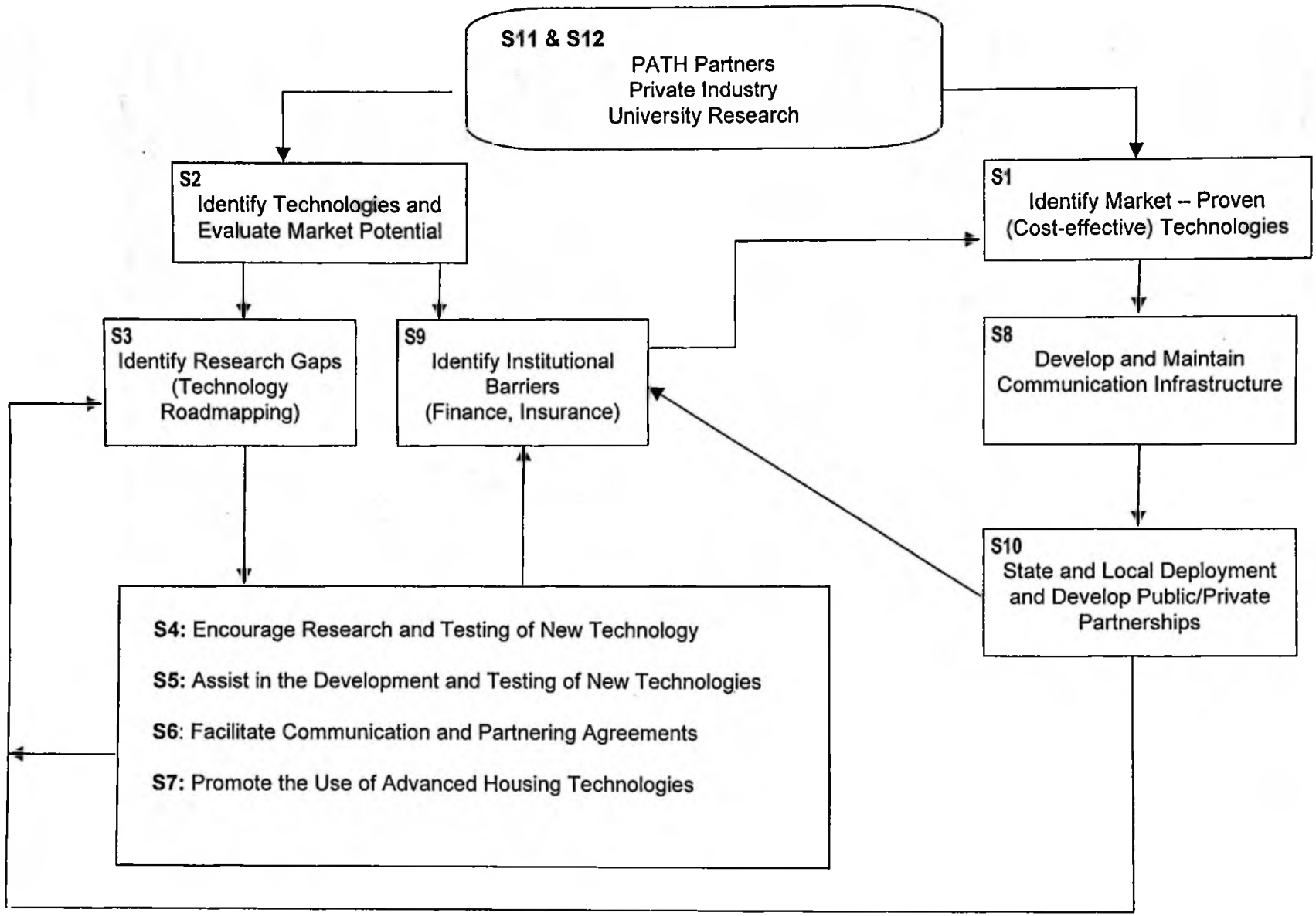
The remainder of this section describes the purpose of each strategic initiative and how it relates to meeting the PATH goals, highlights some of the current PATH activities related to each initiative, and introduces some of the important roles played by specific PATH partners and Working Groups. The highlighted PATH activities and partner roles are presented here only to illustrate the work associated with each strategic initiative, and are not intended to provide a complete accounting of PATH activities and partners.

Dynamic Relationship between Strategic Initiatives

To provide an overview of the PATH strategy, and context for the subsequent descriptions of each strategic initiative, the dynamic relationship between the PATH strategic initiatives is described in Figure 1. The PATH strategy begins and ends with resource coordination (S11 and S12), drawing on the combined resources of the PATH partners and their affiliates to identify technologies that can help to achieve the PATH goals. Market-proven (cost-effective) technologies are identified (S1), promoted by an integrated communications infrastructure (S8) and deployed through coordinated state and local public/private PATH partners (S10).

Resource coordination is also the key to identifying technologies that have a clear potential for contributing to the PATH goals, but that are not yet market-proven (S2). Some of these technologies may have demonstrated technical and financial benefits, but institutional barriers to broader acceptance must be addressed by the PATH Working Groups (S9). Technologies that require further R&D investments to demonstrate their cost and performance characteristics, and gaps in the technology inventory needed to achieve the PATH goals are addressed by the Technology Roadmapping process (S3). The roadmapping process will focus the PATH efforts to encourage research and testing of new technology (S4), assist in the development and testing of new technologies (S5), facilitate communication and partnering agreements (S6) and promote the use of advanced housing technologies (S7) through field evaluations and demonstration sites.

Figure 1


S11 & S12
PATH Partners
Private Industry
University Research
S2
Identify Technologies and Evaluate Market Potential
S1
Identify Market – Proven (Cost-effective) Technologies
S3
Identify Research Gaps (Technology Roadmapping)
S9
Identify Institutional Barriers (Finance, Insurance)
S8
Develop and Maintain Communication Infrastructure
S10
State and Local Deployment and Develop Public/Private Partnerships
S4: Encourage Research and Testing of New Technology
S5: Assist in the Development and Testing of New Technologies
S6: Facilitate Communication and Partnering Agreements
S7: Promote the Use of Advanced Housing Technologies

These R&D activities (S4 – S7) are expected to yield new technologies that can contribute to achieving the PATH goals, based on demonstrated cost and performance characteristics. PATH Working Groups will then consider whether there are institutional barriers to the broader use of these technologies (S9) or whether they can be added to the identified list of market-proven technologies (S1).

The PATH strategy also incorporates several "feedback loops" to identify and remove institutional barriers and to continuously inform the Technology Roadmapping process about lessons learned from R&D activities and from technology deployment. Although the technology roadmapping process (S3) initially determines the focus of PATH R&D efforts (S4 – S7), the research and testing results, cost and performance data, interest in partnering agreements, and unanticipated results of R&D efforts (S4 – S7) will also inform and redirect the Technology Roadmapping process. Similarly, the deployment of market-proven technologies (S10) will help to identify additional institutional barriers that need to be addressed by PATH Working Groups (S9) and cost and performance issues that should be reconsidered as part of the Technology Roadmapping process (S3).

S1. Identify cost-effective technologies that are under-utilized.

To effectively prioritize its research and development investments, the overall PATH program, industry, and the marketplace need to have identified and have access to cost-competitive, fully available, but under-utilized technologies that can make a substantial contribution toward achieving one or more of the PATH goals. For example, if proven technologies that reduce energy use presently have only 10 percent market penetration but could achieve 90 percent of one PATH goal by simply achieving broader market penetration, then PATH should emphasize deployment efforts of these energy saving technologies, and focus its research and development efforts on other goals. Moreover, by encouraging builders and homebuyers to utilize already available technologies, the PATH program will be accelerating the notoriously slow adoption curve in the housing industry. It can be expected that success in expanding markets for these technologies will stimulate additional research by industry.

All PATH partners have been asked to identify proven but under-utilized technologies associated with their respective areas of expertise, and provide available data or rough estimates for the market penetration and the PATH benefits of each technology. Where applicable, separate estimates of market penetration and potential benefit of each technology will be provided for new and existing housing.

Key Activities and Partner Roles

Residential energy efficient technologies promoted by the ENERGY STAR programs and operated jointly by the Department of Energy (DOE) and the Environmental Protection Agency (EPA), are the most significant example of housing technologies that are widely available. However, for various economic, institutional and informational reasons, residential energy efficiency technologies are underutilized in the housing market today.

ENERGY STAR homes offer an economically attractive 30 percent reduction in energy use in new homes relative to the 1993 model energy code (MEC-93). In terms of the Home Energy Rating System (HERS), an ENERGY STAR home has a rating of 86 versus a MEC-93 rating of 80. The HERS rating reflects a variety of factors, including:

- The tightness of the home envelope (air changes per hour, or ACH);
- The energy efficiency ratings for heating, ventilation, and air-conditioning (HVAC) equipment;
- The energy efficiency of hot water equipment;
- The energy efficiency of windows;
- The amount of insulation (in ceilings, walls and floors, and around duct work); and
- The amount of energy leakage from duct work.

The HERS rating, and the ENERGY STAR home label, do not reflect the energy efficiency of other items that contribute to a home's overall utility bill, but other ENERGY STAR labeling programs at EPA and DOE award the ENERGY STAR label to energy efficient lights, appliances, and other products.

Ongoing Implementation

Under the PATH Strategy, ENERGY STAR plays a key role in expanding the market acceptance of cost-effective under-utilized technologies that can make a substantial contribution toward achieving PATH energy goals. Although energy efficiency is the primary goal of ENERGY STAR, these programs also advance other PATH goals:

- ENERGY STAR products can advance the PATH goal of housing affordability with utility savings that more than offset any increase in mortgage cost associated with the slightly higher first cost of ENERGY STAR home features.
- Replacing single-pane windows with high-efficiency/ENERGY STAR double-pane windows can provide improved disaster resistance value in addition to energy efficiency value.
- Durable sealants preserve residential energy efficiency and also prevent moisture penetration that is a key factor in maintenance and replacement costs.

Most importantly, as the lead partners for one PATH Goal– a 30 percent reduction in energy use in 15 million existing homes – EPA and DOE will work with other PATH partners to expand the use of ENERGY STAR products in existing homes. (The consumer education and marketing aspect of this effort is discussed further under Strategic Initiative 8, and the coordination with other federal programs is discussed under Strategic Initiative 10.)

Unlike other PATH goals, the existing housing energy goal calls for a specific reduction in energy usage in a set number of units (30% reduction in 15 million units). Clearly, meeting this goal requires a programmatic approach rather than just the development and deployment of new technologies, as is the case with the other PATH goals.

An existing home education and marketing effort (Strategic Initiative 8) will address home upgrades (through weatherization, lead hazard abatement, ENERGY STAR Home Improvement Program (HIP), HUD rehabilitation programs, and other public and private partners). It will also be applicable to new home programs (through ENERGY STAR Homes, Building America, and other public and private PATH partners). In addition, both the overall PATH dissemination and marketing effort as well as more targeted programs such as ToolBase (see below) will also educate and promote the use of these fully available but underutilized technologies. In all of these activities, PATH, EPA and other Federal agencies will work closely to develop an implementation plan that does not confuse the public through overlapping or conflicting education, labeling and branding efforts that may conflict.

S2. Identify technologies with demonstrated technical potential but limited market share, and evaluate potential for achieving broader market acceptance.

Several factors distinguish the technologies identified under Strategic Initiative 1 from those addressed by Strategic Initiative 2. First, technologies identified under S1 are fully in the market place and cost competitive, whereas those identified under S2 may need more development work or larger scale production to lower their cost to the point where they are competitive in the housing market. Market researchers have established a 5% penetration rate as the point at which a technology is fully in the marketplace. Therefore, most S1 technologies have achieved a market share of least 5 percent, whereas those identified under S2 generally have an estimated market share of less than 5 percent. Finally, the S1 technologies do not generally face building code or other legal barriers to broader acceptance, whereas S2 technologies may face such legal barriers.

The PATH Technology Inventory (available from the PATH web site, www.pathnet.org) constitutes the initial set of housing technologies identified under Strategic Initiative 2. A technology's inclusion in the Technology Inventory is based on two criteria: 1) whether the technology appears to have the ability to advance the PATH goals and 2) whether the technology has 5 percent or less of its potential market share. In the inventory, the technologies are grouped into three categories based on the level of information currently available and their stage of commercialization – whether they appear to be fully mature, emerging, or "on the horizon."

In the early stages of PATH, the technology inventory was based upon the combined knowledge and expertise of PATH staff and contractual support. However, as the program has matured, a more structured approach has been taken. First, all PATH partners are being asked to identify new submissions for the Technology Inventory. In addition, the PATH Office encourages submissions from individual innovators and public or private research organizations that are not actively involved in PATH. Through the PATH web site, NAHBRC ToolBase web site, PATH conferences and workshops, and other outreach and communication efforts by the PATH Office will seek to continuously expand the Technology Inventory. In addition, PATH and NAHBRC staff are making organized visits to product manufacturers, universities and government research laboratories to identify new products and systems.

Technologies identified though this process that are only marginally applicable to PATH goals will be catalogued and an abstract added to an advanced housing technology database. However, these items will not be added to the PATH technology inventory on the PATH web site. Items that have an obvious fit with the technology roadmapping activities or other PATH priorities will be brought into an appropriate activity such as a field evaluation or cooperative research project. These technologies will be written up and added to the PATH Technology inventory.

S3. Identify research gaps in advanced housing technology development to set priorities in support of industry and government research and development.

There are two parts of this strategic initiative to close gaps in advanced housing technology development to achieve PATH goals:

- Evaluating extent to which currently available technologies can achieve PATH goals; and
- Technology Roadmapping to develop new technologies to achieve PATH goals.

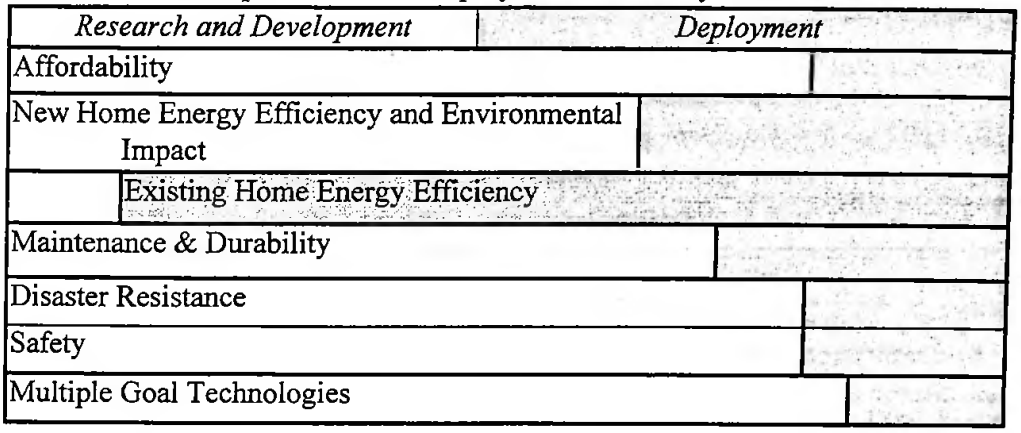
Evaluation of Available Housing Technologies

Before major resources are devoted to developing completely new technologies, it is essential to evaluate already emerging technologies to determine the extent to which they can achieve each of the PATH goals. These evaluations allow PATH to better assess what improvements can be made in these technologies and whether they are ready for full-scale market deployment and acceptance. This evaluation process also determines the broad outlines of where PATH needs to encourage more research efforts to develop new technologies that will close the gap between the PATH goals and the current state of proven housing technology.

Figure 2 provides general estimates on how the PATH goals are expected to require different levels of effort for technology development versus technology adoption if each goal is viewed independently. Achieving PATH Goals for affordability, durability, disaster resistance, and safety is expected to require a significant research and development effort leading to new housing and construction process technologies. Achieving a 50 percent reduction in new home energy consumption and environmental impact would require less research and relatively more deployment effort because DOE and EPA have already identified a number of cost-effective technologies to advance this PATH goal.

However, the state of technological development is actually far less advanced when the interdependent nature of the PATH goals is considered. To achieve multiple PATH goals with the same technology while reducing monthly housing costs by 20 percent will require far more research, even in advanced areas such as energy technologies. The existing home energy efficiency goal may be almost entirely achievable through existing technologies, but if these investments are to be made in housing occupied by lower-income families, either additional research to increase energy savings, cost reductions, or subsidization may be required.

Figure 2
How Expected Allocation of PATH Resources between Research and Development versus Deployment Varies by PATH Goal



Technology Roadmapping

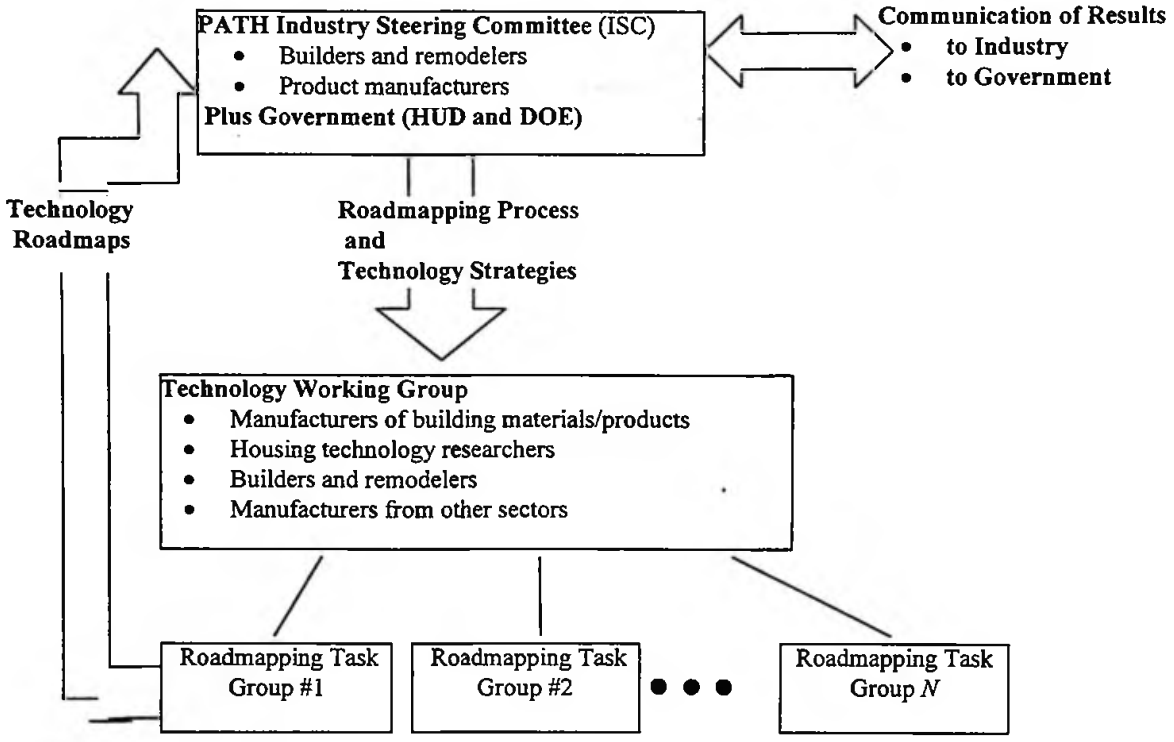
The identification of the needed technologies for PATH to meet its goals is one of the most essential activities in the overall PATH strategy. "Technology Roadmapping" is a process of defining and organizing potential R&D activities to facilitate decisions about resource allocation and achieving specified ends. A useful Technology Roadmap will include a graphical depiction of a series of steps starting from the present state of the art and progressing up to the availability of a desirable new technology or technological capability. It will also include background information about R & D that has already been performed or is currently underway, an analysis of the technical obstacles separating the present from the future, a timeline and an analysis of the costs of individual steps. In the case of PATH it will also be important to consider the most appropriate place to perform and way to fund possible types of R & D. These answers will depend on the necessary amount of work, the skills required to perform it, and the degree to which private sector firms can realistically hope to protect the results from their R&D and realize sufficient returns at a pace that will motivate up-front investment. The latter issue has been recognized as a major impediment to development of new products and methods of construction for use in home building.

What makes PATH's roadmapping so unique is that PATH is focused on the simultaneous pursuit of multiple goals, as discussed earlier, while other roadmapping activities frequently begin by developing a vision and ultimately pursue a single goal or narrower set of goals. PATH is also addressing the totality of the home and all the products and systems that make it up, so it cuts across many different areas of manufacturing and product development.

Two groups will be actively involved in PATH technology roadmapping: The PATH Industry Steering Committee (ISC) and the Technology Working Group. The general role of the ISC will be to provide oversight ensuring that the roadmapping process is workable, focuses on areas

considered most important, and leads to outputs that are responsive to industry needs. The industry leadership represented on the ISC will also have a key role in communicating roadmapping results to industry and government. The general role of the Technology Working Group will be to apply creativity and subject matter expertise to identify and assess multiple technological options for the implementation of broadly defined technology strategies. The overall roadmapping process is described in Figure 3. Additional information on the PATH roadmapping process can be obtained at http://roadmap.nahbrc.org.

Figure 3 -- PATH Technology Roadmapping Approach



The Technology Working Group will identify specific technical barriers that currently impede or rule out promising options and develop technology roadmaps that address these barriers and lead to endpoints that achieve the PATH Goals. Task Groups drawn from the Technology Working Group and others with expertise specific to the individual task will conduct Roadmapping for specific technologies.

Chronological description of the roadmapping approach

The steps for developing the PATH Technology Roadmaps are listed below:

1. The ISC lays out an initial set of technology strategies that have potential for addressing PATH goals to form a starting point for work by the Technology Working Group. (This has been completed.)

2. The Technology Working Group:
   a) Meets and brainstorms technology options based on the initial set of technology strategies forwarded by the ISC and listed on the PATH Technology Inventory, as well as any other technology strategies identified by the Technology Working Group;
   b) Assesses the likely benefits in relation to advancing PATH Goals, development costs, technical risks and time required for each identified technology option;
   c) Uses the assessments to select a portfolio of high-priority technology options for early roadmapping, including a mix of short-term and long-term, low-risk and high-risk technology options for implementing the technology strategies;
   d) Proposes technology roadmapping task groups to develop roadmaps for those technology options that are determined to be high priority; and
   e) Submits its recommendations for roadmapping topics and task groups to the ISC for review and approval.

   All the above activities are currently underway.

3. The ISC reviews, comments on, revises, and ultimately approves development of roadmaps for high-priority technology options identified during the brainstorming, by associated Task Groups assigned responsibility for developing one or more roadmaps. Members of Task Groups will be drawn from the original Technology Working Group and supplemented by additional manufacturers and researchers with knowledge and interest in the technology areas assigned to the group.

4. The Technology Roadmapping Task Groups identify the technology barriers or gaps in knowledge that must be addressed during R&D leading to a defined endpoint or technology option. They develop roadmaps that set forth the timing, phasing and interrelations among different tasks needed to overcome those barriers and make available technology solutions that contribute to achieving the PATH goals, and allocate responsibility for performing necessary work between industry and government.

5. The ISC reviews and approves individual technology roadmaps developed by the Task Groups, and communicates results and recommendations for programs of work based on the roadmaps to the government and to private industry.

6. The Technology Working Group and ISC will continue roadmap development for other promising technology options identified during the brainstorming, working from higher to lower priority. The ISC monitors progress on work called for under the roadmaps, maintains or updates individual roadmaps as required, and periodically reassesses the prioritization of R&D projects incorporated in the roadmaps.

It is also expected that the Technology Roadmapping process will develop recommendations for additional research, testing, development and demonstration support for promising housing technologies. In this capacity, the Technology Working Group will coordinate as needed with the National Science Foundation and the National Evaluation Service (under Strategic Initiative 4), NIST (under Strategic Initiative 5), and the PATH Office, DOE, and HUD (under Strategic Initiative 6).

S4. Encourage basic research and testing of new housing technologies through better coordination and documentation of government, university, and industry research.

The need to develop innovative cost-effective building products and systems and new ways of building homes is the underlying assumption of PATH and key if the program is to meet its ambitious goals. Most of this research and testing responsibility falls upon PATH partners in the private sector. PATH must challenge and stimulate interest by private industry in R&D investments that meet PATH goals. The housing industry has historically under-invested in both basic and applied R&D. The ultimate measure of success for PATH is whether this can be significantly altered. Working with industry, PATH hopes to develop a baseline of industry R&D investments and develop a methodology for tracking both quantitative and substantive changes in investment patterns. Encouraging private investment also requires eliminating or reducing many of the barriers to R&D investment. Liability issues, codes, market fragmentation, and a lack of consumer awareness contribute to notoriously attenuated adoption curves for new housing technologies. By shortening the time from development to widespread market adoption, PATH can hopefully improve the return on investment for industry and thereby encourage increased investment. The PATH Working Groups are addressing all these issues. For example, the PATH Barriers Working Group is developing a program model that can, if adopted, limit the liability and exposure to risk of homebuilders that try innovative technologies.

The Federal government can also stimulate more and better-informed research through better coordination and documentation of government, university, and industry efforts to achieve the PATH goals. The PATH Operating plan details the myriad activities agencies currently have underway in support of PATH and is the first step in eliminating duplicative research and in identifying major gaps in Federally supported research. Subsequently, the Plan will be used by participating federal agencies in developing shared and supportive research planning and activities .

The National Science Foundation (NSF) has agreed to assist PATH by serving as a catalyst for industry-university partnerships and by supporting the discovery of new knowledge that will advance the PATH goals. To this end, with joint funding from NSF and PATH, NSF has initiated a program to support fundamental research that contributes to the achievement of the PATH objectives. This initiative focuses on the application of a broad array of engineering sciences and technologies, and will encourage cooperative and interdisciplinary activities. Far-reaching exploratory research that can lead to break-through technologies and engage the transcendent technologies–sensors, advanced materials and information technology – is encouraged. In late Spring 2000, eleven grants are being awarded under the first solicitation, and additional solicitations are anticipated in FY2000 and beyond.

This special program is an important step in Strategic Initiative 4, which aims to encourage university-industry partnerships by making funds available to support a number of industry-university linkages including:

- Faculty, postdoctoral fellows and students to conduct research and gain experience with production processes in an industrial setting;
- Industrial scientists and engineers to bring industry's perspective and integrative skills to the academic world; and
- Interdisciplinary university-industry teams to conduct long-term projects.

The purpose of the NSF-PATH effort is to support fundamental research that can help to advance the PATH goals. This initiative focuses on the application of a broad array of engineering sciences and technologies, and will encourage cooperative and interdisciplinary activities. Far-reaching exploratory research that can lead to break-through technologies and engage the transcendent technologies–sensors, advanced materials and information technology – is encouraged.

PATH funds are being used to close major research gaps not previously covered by the research of existing agencies or to fund research that is high priority for PATH meeting its goals. For example, durability is a priority for both builders and consumers. Advanced technology is not truly effective unless it provides longer-term benefits that can reduce maintenance costs. However, until the advent of PATH, there had been almost no overall research to define or better understand the durability issue. As a result, HUD and the National Institute of Standards and Technology (NIST) created the PATH-Durability Research Program (PATH-D). This program will provide an accurate prediction of the service life of housing materials and components, allowing builders and consumers to make a more informed choice when evaluating housing plans. With funds provided by PATH, the NIST Building and Fire Laboratory will coordinate the private and public laboratory research effort to achieve the PATH goal of improving durability and reducing maintenance costs by 50 percent by 2010.

The PATH-D agenda calls for researchers to develop an industry-wide consensus on what constitutes durable materials or products, how durability should be measured, how products should be measured, and how products should be rated. Initially, researchers will look at the durability of roof and wall components and how well they attach to one another. The service life of sealants, the main line of defense in preventing moisture penetration around window and doorframes, will also be considered.

Other agencies will continue their own research in support of PATH goals. DOE will continue to support advances in lighting, windows, insulation, building materials, appliances, weatherization, and whole-building design. PATH staff will assist all participating PATH agency partners to help assure that the PATH goals are integrated into each agencies research planning. Particular emphasis will be placed on "mining" the research capability of the various national laboratories developing a coordinated research agenda. The Forest Product Laboratory (FPL) of the Department of Agriculture has established a PATH Wood Industry Consortium that is developing a long-term wood products research agenda, especially in the area of durability. With PATH funds, the FPL has expanded its research activities.

S5. Assist in the development and testing of new technologies that meet the PATH goals.

Under Strategic Initiative 4, PATH is helping to create the communications processes and organization infrastructure needed to support collaborative academic and industry research and testing for new housing technologies. Under Strategic Initiative 5, key PATH partners directly support research and development efforts that specifically target the achievement of PATH goals. To implement this Strategic Initiative, PATH's partners are sponsoring research, development, and testing for housing technologies that can achieve the PATH goals. For example, the Dow Chemical Company is working with PATH to apply the technology of vacuum insulation to housing products.

Another new PATH-sponsored initiative seeks to accelerate industry R&D investment by making it easier for industry to receive comprehensive evaluations on their new building products. New building products and systems need to be subjected to a credible evaluation before they can be effectively promoted and brought into the marketplace. Evaluations are critical in order to know what technologies are truly innovative and useful. Using PATH funding, NIST is leading a program providing technical assistance to the National Evaluation Service (NES) which has established a Building Innovation Center (NES-BIC) to evaluate building technologies beyond minimum code requirements. NES-BIC provides an independent technical evaluation of building technologies of all types. This independent evaluation can be used by innovators, designers, and by those who own and operate facilities to gain credible information on the performance of new technology.

The NES-BIC program components include a supplemental evaluation fee program, a communications and outreach program, and a durability/Service Life Prediction Protocol. The supplemental evaluation fee program provides innovators with the opportunity to determine what the evaluation requirements will be related to their technologies so that the evaluation costs (tests, calculations, field demonstrations, etc.) can be determined early in the design of their marketing processes. The Durability/Service Life Prediction Protocol will provide a rigorous, relatively comprehensive approach to determining appropriate areas for service life prediction and evaluation assessments, and serve as the basis for evaluation planning regarding this important characteristic.

S6. Facilitate communication and partnering agreements between housing technology innovators, housing component manufacturers, and builders to accelerate the development of new technologies.

To carry promising housing technologies beyond research and initial testing, PATH also is helping to facilitate technology development up through commercial applications. An example of a PATH effort aimed at stimulating cooperative public/private research is the PATHCoRP program. PATHCoRP is dedicated to accelerating the research and development of innovative and advanced technologies. All selected technologies for PATHCoRP must address one or more of the PATH goals. Specifically, this initiative, funded by PATH and administered by NIST, is a multi-year program of cooperative R&D agreements with industry to speed the development

and commercial use of innovative housing technologies. PATH provided $1.5 million for the first year of this effort, and the NIST Building and Fire Research Laboratory is administering PATHCoRP. NIST, working with other PATH partners, will identify prospective candidates and technologies for the cooperative partnerships. NIST also will announce openings for participation in the cooperative research program through media such as the Commerce Business Daily and the PATHnet and NAHBRC TOOLBASE web pages.

The Technology roadmapping process described earlier will guide future PATHCorp solicitations so that available public resources are focused on developing the most promising new technologies.

S7. Promote the use of advanced housing technologies in "real life" housing developments to familiarize builders with innovations; capture installation, cost and performance data, and gain consumer feedback.

Within their mission responsibilities, each agency will continue to conduct demonstrations and field evaluations that support the objectives of PATH. PATH will seek to serve as an information broker for these activities. Agency reports on these activities, when made available, will be consolidated for use by the PATH partners. In addition, to prove the value of advanced housing technology in commercial applications, PATH will also directly support National Pilots, Demonstration sites, and field evaluations that showcase housing technologies that advance the PATH goals. Builders and nonprofits are matched with housing technology product manufacturers, with technical assistance provided by PATH contractors. Information gathered by these efforts will be disseminated to builders and product manufacturers through ToolBase, PATHnet, and other information dissemination efforts.

PATH Field Evaluations

Field evaluations are the initial step used by PATH to introduce technologies into the homebuilding industry. Although many PATH technologies are not new, the information available to the industry on many of the technologies is either vague or nonexistent. Information gathered by the PATH contractors in field evaluations will fill these information voids. A field evaluation is structured to give primacy to the collection of data on a new technology and is organized as a more controlled environment than a "demonstration" or "national pilot." This comprehensive evaluation is necessary to determine a technology's potential for advancing the goals of the PATH program (see Strategic Initiative 3 above).

National Demonstration Sites

PATH Demonstration sites integrate several technologies into "the home as a system" approach and are comprised of entire subdivisions containing between 25 and 100 units. PATH is working with builders at these sites throughout all phases of the projects to illustrate and evaluate how PATH technologies perform on a community-wide or production scale. These demonstration sites, managed by HUD, focus on technologies whose cost and performance is well documented.

The relatively small scale and duration (usually 2 years) of the projects will allow prompt feedback to the building industry.

Armory Park del Sol

The first PATH demonstration projects was Armory Park del Sol which will create a sustainable community in the historic Armory Park portion of inner city Tucson. It will consist of 99 single-family homes affordably priced from $80,000 and equipped with cutting edge solar technologies to provide electricity, hot water and heating. Some key aspects of Armory Park del Sol's design and technology that help move PATH towards the goals of reduced environmental impact and increased durability are:

- Precast concrete to provide durable, energy efficient walls to frame the homes (which will lower utility usage and therefore cost).
- High-density urban infill development techniques in an effort to preserve open spaces.
- Extensive walkways to encourage pedestrian traffic, reducing the negative effect of vehicle emissions on the environment.
- Use of water saving technologies (greywater irrigation) and native vegetation in landscaping to reduce water consumption by approximately 65 percent when compared to typical homes.

PATH will also receive and disseminate research results, technical and market data and builder feedback from the DOE's Building America program. These demonstrations should provide important information necessary for the widespread market acceptance of these technologies and building practices.

National Pilot Sites

National Pilot Sites are large, highly visible projects that help further the PATH goals by modeling new land planning and design techniques and highly innovative technologies that cut environmental impact and energy use. The National Pilot Sites are large-scale developments containing hundreds to tens of thousands of homes. Pilot projects include Village Green and Playa Vista in Los Angeles, Civano in Tucson, Stapleton Airport in Denver, and Summerset in Pittsburgh. The Department of Energy's 'Building America' program has the lead responsibility for technical assistance for these pilots. Other PATH Federal partners are asked to work together to provide additional assistance to these project sites.

Village Green

Village Green is a 186-unit subdivision of affordable, energy-efficient housing with a number of characteristics that showcase how technologies can help achieve PATH's goals.

- Village Green is built on an in-fill site (an area where the utilities and roads are already in place). This design characteristic cuts building costs, and the new community will contribute to the existing urban environment rather than continue urban sprawl.

- The 180 of the homes will have photovoltaic systems to provide up to 90% of electrical needs, and the site is conveniently located next to a Metrolink transit station, encouraging use of public transportation. A forced-air duct distribution system ensures that all ductwork is contained within the home's thermal barrier (because ductwork that is located in exterior walls or attic spaces can leak and lose energy, increasing energy costs).

- Solar control glazing for windows lets visible light through, but keeps the solar heat out in summer and the heat inside for winter. Monthly utility bills are expected to be up to 50% lower than conventional homes through a partnership with the Los Angeles Department of Water and Power and BP Solar.

- Village Green's builders used the Department of Energy's Building America's systems engineering approach, and the homes more than meet the energy efficiency standards for the ENERGY STAR Homes Program, surpassing the requirements of the Model Energy Code and saving up to 40% in monthly energy bills.

S8. Develop and maintain a communication infrastructure that provides reliable, useful information to the consumer, builder, and other key stakeholders regarding the use and acceptance of advanced housing technologies.

The Industry Implementation Plan for the Residential National Construction Goals ("Building Better Homes At Lower Cost," January 1998) identified as a high priority the need for an objective and reliable information system that is responsive to the needs of builders and consumers. Providing information to decision-makers and early adopters in the highly fragmented housing industry has always presented a challenge. The rapid growth in electronic access to large volumes of information, which has been transforming many industries, has heretofore been minimally applied in the housing industry. PATH will make information and communication a key component of its strategy. Some basic concepts that will be followed include providing objective, high-quality content, information to multiple sources, and information for problem solving.

Under this strategic initiative, PATH will implement a 3-part information and communications strategy directed at housing industry professionals (builders, remodelers, and manufacturers), consumers (homeowners and residential property owners) and other key stakeholders.

Housing Industry Professionals

For PATH to succeed, the flow of information to builders, remodelers and back to manufacturers must be fast, responsive and reliable. This communication effort must attract the attention and

interest of building and remodeling industry professionals, but also must translate this interest into real changes in industry practices, accelerating the use of advanced housing technologies. PATH will also provide technical information tailored to the needs of the remodeling industry.

The primary vehicle for disseminating this information to the housing industry is TOOLBASE SERVICES. TOOLBASE SERVICES is a technical information resource co-funded by PATH and private industry in cooperation with the NAHBRC. TOOLBASE provides easy access to information on new housing technologies, quality management techniques, and best practices for residential construction. TOOLBASE SERVICES is the key information link between the PATH program and the home building and remodeling industry, and includes the following:

- The ToolBase web site (www.nahbrc.org/TOOLBASE) provides comprehensive resources to a broad range of technical and information services. ToolBase maintains the PATH technology and demonstration inventory and increasingly is becoming the portal of choice for those seeking housing technology information.

- The TOOLBASE Hotline: A toll-free telephone resource for building and remodeling professionals to discuss building problems and product failures, technical solutions and resources, and ways to get information on new products and materials with NAHBRC residential experts. The hotline number is 1-800-898-2872.

- Ask an Expert: A way for building and remodeling professionals to ask questions or share experiences and receive technical advice through e-mail.

- The Catalog of Building Products and Services: Published on CD-ROM and on the Internet.

- Technical briefs, fact sheets, and other useful references for builders and remodelers.

- TOOLBASE NEWS: A technical newsletter distributed quarterly through NAHB homebuilder associations to nearly 70,000 builders, remodelers, and contractors nationwide. Current and previous issues are available on the TOOLBASE SERVICES web site.

- Information on Green Building Practices.

Another information approach being tested by PATH is the "Hands-On Builder" effort. In this partnership between PATH, Builder and Fannie Mae, PATH is sponsoring the Hands-On Builder: A Technology Lab for Builders meetings, where builders who have experience installing PATH-evaluated technologies teach other builders about their proper installation. Hands-On Builder will hold three regional meetings, evaluate the effectiveness of the program, and then incorporate the lessons learned in the subsequent meetings.

PATH also engages in its own direct programs of information dissemination to the home-building industry. HUD and PATH produce over 15 major technical publications a year directed at advancing the homebuilding industry. PATH directly participates at trade shows, especially

the NAHB Builders show at which there were three PATH-assisted demonstration homes on exhibit. The PATH website (www.pathnet.org) also serves as a portal to the ToolBase information program.

International Cooperative Efforts

PATH is also briefing and cooperating with representatives of other countries on issues of improving housing technology. Among other activities, PATH has attended the Habitat II conference in Nairobi , Kenya; exhibited and presented at the 2000 China International Exhibition on the Housing Industry; briefed visiting officials from countries including Mexico; and proposed a study tour plan for Israeli officials to learn about advanced housing technology in the U.S. PATH expects additional cooperative activities with countries to which HUD has made commitments on housing technology transfer, including China and Israel.

Communications with Consumers (Homeowners) and Residential Property Owners (Landlords)

Although educating builders and the housing industry is receiving much of PATH's allocation of resources for marketing and information dissemination, the PATH strategy recognizes that consumer awareness of, and demand for, advanced housing technologies will be the ultimate measure of PATH success. Therefore, PATH must also develop an extensive program of consumer education and outreach. Although a home is generally the largest consumer purchase anyone makes in a lifetime, consumers are, in most cases, surprisingly uninformed about the nature and type of construction and equipment in the home. If PATH is to have long-term success, consumers must place value in new technologies that will increase durability, save energy or reduce the dangers of disasters.

However, any large-scale program of consumer education and awareness would be very expensive. Therefore, PATH's strategy is two-fold. First, target PATH's educational and informational activities to early adopters. Second, utilize the resources of private industry and other educational programs such as EPA's ENERGY STAR to effectively target consumers.

The PATH web site (www.pathnet.org) will be the main communications vehicle for the PATH program because of its quick updating capability. The web site is newly redesigned with a user-friendly interface. To those who have previously expressed interest in PATH's activities, the PATHWays Newsletter is distributed quarterly. PATH representatives also will attend selected conferences where there are likely to be early adopters for new technology and may also place PATH Kiosks at selected home improvement stores.

PATH will also target mass media. The actions associated with the press are twofold: reactive and proactive. Key press targets include newspapers, magazines and television. In the middle of FY2000 (or when there is an appropriate event to report), the PATH Office will send a direct mailing to members of the press.

ENERGY STAR® is a voluntary partnership among the U.S. Environmental Protection Agency, U.S. Department of Energy, product manufacturers, local utilities, and retailers. Partners help promote efficient products by labeling with the ENERGY STAR® logo and educating consumers about the benefits of energy efficiency. The ENERGY STAR program will provide two additional consumer-marketing tools that will contribute to meeting the PATH goals. First, ENERGY STAR products provide consumers with a simple way to tell that their energy bill savings will more than justify any additional up-front cost for an ENERGY STAR product. Second, new homes built under ENERGY STAR will provide homeowners with a verified measure of their home's overall energy efficiency (i.e. 30% above Model Energy Code). In addition to advancing the PATH energy efficiency and affordability goals, raising the visibility of the ENERGY STAR marketing message would also demonstrate the ability of PATH to educate consumers about the value of all the PATH goals. Lessons learned from a coordinated PATH approach to promoting ENERGY STAR products could then be applied to durability, disaster resistance, and safety technologies as more of these PATH technologies are tested and proven effective in demonstration projects.

Other areas for consumer outreach include:

- Working with homeowner counseling organizations (particularly those funded by HUD)
- Disseminating materials through HUD's HOME, HOPE, CDBG programs
- Increasing public education programs regarding FHA's Energy Efficient Mortgages (EEMs)
- Encouraging partners such as Fannie Mae and Freddie Mac to increase their efforts to educate consumers about their EEM and Green Mortgage products; and
- Encouraging utilities and states to expand their education and financing programs

Education & Outreach to Upgrade Existing Homes

While consumer education is an important contributing element to all aspects of the PATH R&D strategy, for the existing home energy efficiency goal it is essential. By requiring that the energy use in 15 million units be reduced by at least 30%, this goal requires an immediate outreach and education strategy targeting consumers. The other PATH goals require advances in housing technology that may or may not be available and widely accepted by homebuilders prior to year 2010. The energy efficiency goals for new and existing homes are the only PATH goals for which an established inventory of proven technologies already exists, and EPA and DOE have been actively promoting these technologies through the ENERGY STAR program. For these reasons, the PATH strategy calls for the ENERGY STAR program to play a lead role in the initial PATH communications strategy targeting consumers (homeowners) and residential property owners of existing homes.

The new ENERGY STAR Home Improvement Program (HIP) will be the basic starting point for coordinating the existing home program and will target transaction points where home improvement expenditures are most likely. These transaction points include renovations, home sales, refinancing, and major repairs. The strategy is to market ENERGY STAR at times when homeowners already intend to improve their homes, rather than to make efficiency improvements solely for the purpose of lowering utility bills.

This strategy will be implemented through: 1) marketing alliances with retailers who sell home improvement products and services, utilities, and state and local governments; 2) web site tools that will educate homeowners about improvements that can be made at the time of targeted transaction points; and 3) conference and media campaigns. HIP has grouped the transaction points into three categories:

1. Whole Room Upgrades, including kitchens, home offices, bathrooms and additions;
2. Whole Home Upgrades, including duct sealing and envelope sealing
3. Resale/Purchase transactions

The Whole Home upgrade category will encourage labeling of homes that reach the ENERGY STAR new homes standard with the ENERGY STAR label. Homes that cannot be cost-effectively brought up to the new home standard may be labeled as "Energy Improved." As part of the HIP strategy, EPA will work with lenders to expand the scope of current ENERGY STAR mortgages and loans to include all transactions targeted by the HIP program. In addition, EPA will work with Fannie Mae to develop home improvement loans for utilities, and build upon Fannie Mae's new energy efficient mortgage product. Finally, EPA will recruit lenders to provide home equity loans and lines of credit for both ENERGY STAR and Energy Improved homes.

EPA and DOE, as leaders of this component of the PATH strategy, will obtain projections on energy reductions due to the implementation of the HIP Program for different market segments. EPA will also project the energy use reductions due to the purchase of ENERGY STAR Products for existing homes through the year 2010. These projections will need to be separated into different segments so that it is clear when these products are being used in the programs described below.

Other Energy Efficiency and Housing Rehabilitation Programs

Although ENERGY STAR will be the main PATH vehicle for addressing energy investments in existing housing, the PATH goal of reducing energy use by at least 30% does not require existing homes to meet the ENERGY STAR level of efficiency. Moreover, ENERGY STAR is a market-based program. The housing and energy needs of lower and moderate- income families must also be addressed. Not only is this important for meeting PATH's energy goals, but it is also demanded by simple equity. Federal, state and local government agencies, as well as non-profit organizations and private sector companies, also have programs to encourage housing rehabilitation. These programs present additional opportunities for communicating with consumers and housing developers to promote energy efficiency. To achieve the PATH existing-home goal, PATH and ENERGY STAR will develop a coordinated consumer-marketing message across the following energy efficiency and housing rehabilitation programs.

- The DOE Weatherization Assistance Program (WAP) funds energy efficiency investments for low-income households through a network of local weatherization agencies. This program can play a significant role in the PATH existing homes goal. The Program has

already conducted energy saving retrofits in over 4.7 million homes of low-income families in all 50 states. Program expansion strategies have been proposed to increase the annual number of homes weatherized and to focus on achieving 30% energy savings in a growing subset of those homes. Under the optimal proposed budget, 1 million additional homes would be weatherized at the 30% savings level by 2010, with the direct appropriations proposed by DOE. If the 2 for 1 leveraging is assumed, 3 million homes would be upgraded, which would represent 20% of the PATH existing homes goal. (Weatherization funds are often leveraged with other private or public funding).

- HHS's Low Income Home Energy Assistance program (LIHEAP) awards $1.1 billion (FY 99) in annual grants to States. Although these funds are primarily used to help low-income households cover their home heating and cooling costs, the funds are also used to pay for repairs to make their homes more energy efficient.

- HUD's HOME program grants $1.6 billion annually (FY 2000) to States and localities for affordable housing programs. From FY 96-FY 99Q3, grantees committed $3.8 billion to rehabilitation projects affecting 226,885 units. While HOME-funded rehabilitation tends to focus on improving the condition/safety and affordability of housing, HOME funds can also significantly improve the energy-efficiency of the improved units.

- HUD's Community Development Block Grant program (CDBG) grants $4.8 billion annually (FY 2000) to States and localities for economic and community development activities that benefit low-income individuals. Eligible CDBG activities include housing rehabilitation and energy-efficiency programs.

- HUD's Lead Hazard Abatement Program grants $80 million (FY 2000) to States and localities to reduce and abate lead-based paint hazards in housing. Although the focus of these grants is clearly the lead-based paint hazard, there are often opportunities to make energy-efficiency upgrades at the time of the abatement work, as in the case of window replacement. Combining weatherization and lead hazard abatement can also leverage available funding sources.

- The Low-Income Housing Tax Credit (LIHTC) allows States to allocate over $3 billion annually in tax credits that are syndicated to provide equity for affordable rental housing development and rehabilitation. Through the program, roughly 19,000 units are rehabilitated annually at an average cost of $48,000 per unit. Some states place priority on energy efficiency projects.

Numerous other programs could also be included in this list, from Public and Assisted Housing initiatives, to State housing bond and trust fund programs, to other Federal agencies that own housing, such as DOD. Finally, the lending community has products that are available to household with all incomes, not just lower-income such as the FHA 203(k) and Title I loan insurance programs and the various Freddie Mac and Fannie Mae loan products designed specifically to encourage rehabiltation. Every time a home is rehabbed, repaired or remodeled,

opportunities for energy improvements open up. These programs have a potentially very large market penetration and greater emphasis will be given to educating consumers on using those products to increase their homes energy efficiency.

S9. Identify institutional barriers to housing technology deployment and provide solutions.

Under Strategic Initiative 3, the Technology Working Group plays a key role in identifying technological barriers to achieving the PATH goals. However, beyond technological impediments, there are many other barriers to market adoption. Under Strategic Initiative 8, the Consumer Education Working Group and other PATH communications efforts are responsible for addressing informational barriers to the acceptance of new housing technologies that advance the PATH goals. Strategic Initiative 9 encompasses the work of the Barriers/Insurance, Quality, Finance, and Labor Working Groups. Each of these groups will examine and address institutional (non-technical and non-market) barriers to achieving the PATH goals. The issues to be addressed by these Working Groups include, but are not limited to, building codes, insurance protocols, mortgage underwriting requirements, and construction labor rules. It is expected that these groups will go beyond issue identification and recommendations for action. Members of these groups, individually or collectively, can actively work with governments and industry to fashion solutions, pilot programs, and other initiatives that will actually reduce or eliminate these barriers.

S10. Integrate the use of advanced housing technologies in specific federal housing programs, and develop local and regional public/private PATH partnerships.

As noted under Strategic Initiative 8, EPA, DOE and the PATH Consumer Education Working Group will work with HUD staff and other Federal agencies to promote the use of ENERGY STAR products and technologies that achieve other PATH goals across all of the following programs:

- HUD HOME program grants
- HUD Community Development Block Grant program (CDBG) grants
- HUD Lead Hazard Abatement Program grants
- Low-Income Housing Tax Credit (LIHTC)
- Other Public and Assisted Housing initiatives
- HHS Low Income Home Energy Assistance program (LIHEAP)
- Other Federal agencies that own housing such as DOD
- EPA and DOE ENERGY STAR labeling program
- The ENERGY STAR home improvement program
- The DOE Weatherization Assistance Program
- The Federal Energy Management Agency.

Under the existing home strategy, EPA, working with DOE and the PATH office, will take the following steps to refine and begin to implement the strategy:

1. Meet with key PATH partners to discuss their program activities and strategies relating to existing home upgrades.

2. Decide on an existing home ENERGY STAR label and/or ENERGY STAR product message that could be communicated through all PATH partners with marketing channels relating to existing home upgrades.

3. Meet with key PATH partners to discuss revised and detailed existing-home strategy, and how the ENERGY STAR message could also serve their related program objectives.

4. Develop consistent marketing message for consumers, and technical assistance and/or training materials for contractors and for state and local government partners, to be disseminated through all of the PATH partner marketing channels for existing homes.

5. Identify target markets and develop local or regional extensions of the PATH partnership for ENERGY STAR upgrades for existing homes.

Many Federal programs have their own networks of state and local affiliates or grantees. Extending the existing home initiative to this state and local level is essential. In addition, state and local governments can also play an important, but somewhat lesser, role in addressing the other PATH goals. Establishing a coordinated approach to achieving the PATH existing home goal can also assist in achieving other PATH goals. Many barriers to market deployment of new technologies vary with local codes and state insurance regulations. The need for disaster-resistant and energy-efficient housing technologies will also vary by locality.

As part of the PATH program, each agency must work with and through their respective state and local government networks to encourage the use of PATH technologies and remove any programmatic or regulatory impediments to their use. Housing rehabilitation is a high priority for HUD and other PATH partners in part because older housing is often the most affordable segment of the housing market, and rehabilitation preserves these affordable housing units that might otherwise be demolished. Rehabilitation efforts offer an opportunity to address multiple PATH goals at one time. For example, replacing old windows with more energy efficient windows also removes the lead paint on older windows, emphasizing occupant health and eliminating an environmental hazard; removing lead hazards on windows is a top priority for the HUD Office of Lead Hazard Control. Replacing HVAC units is one way to address indoor air problems due to back-drafts from older furnaces, which is a high priority for EPA, the HUD Healthy Homes initiative, and several state programs that seek to address indoor air quality together with energy efficiency. HUD's HOME program, HOPE VI and public housing modernization are also candidates for PATH technologies. Window replacement and insulation/envelope upgrades are often especially economical in conjunction with other housing rehabilitation work.

S11. Coordinate government program efforts to work more effectively with each other and the housing industry to create outcomes that are more than the sum of individual efforts.

A significant contribution of the PATH initiative to date has been bringing together the numerous Federal departments and agencies working in the area of housing-related technology. Prior to the PATH initiative, much of the progress made through these government programs was targeted toward addressing the needs of each individual program. With PATH, these government programs not only must make individual contributions toward the achievement of the agencies own goals and mission, but also, alter and broaden their focus and impact to address overarching housing technology issues more generally as well as the PATH goals.

More effective coordination between government programs and the housing industry requires active interaction and communication. The PATH strategy addresses fostering participation among government programs and the housing industry through the sharing of appropriate information and resources. The following specific mechanisms have already been established at PATH to facilitate such coordination:

- The Federal Agency Working Group
- The Industry Steering Committee
- Other public/private PATH Working Groups (i.e. Finance, Insurance/Barriers, Consumer Education)
- The PATH-D effort
- PATH Industry Road Mapping

In addition to these mechanisms, the PATH Operating Plan database (attached) has been designed to track the activities of these efforts for the benefit of all partners. The first PATH Operating Plan was a static document that highlighted the activities of a number of partners as they related to the four PATH goals. The new Operating Plan database attempts to link the activities of PATH partners to the four PATH goals and the twelve Strategic Initiatives. This new database format allows PATH partners to sort the information by PATH goal, Strategic Initiative, activities for which they have the lead, or another field in which they are interested.

S12. Coordinate efforts to leverage public and private resources for achieving the PATH goals.

Over the coming months, the PATH Operating Plan database will be updated to begin incorporating information on the public resources associated with each activity identified in the plan. A second step involves identifying and incorporating investments from private industry by quantifying information on the private commitments directly associated with cooperative public/private activities in support of the PATH strategy. A far more difficult task will be identifying and measuring change in the nature and extent of private investment in research in support of the PATH goals. To the extent such information is identified, it will assist the PATH

program, as well as PATH's public and private partners, in coordinating their efforts to achieve the PATH goals.

The PATH Office and partners will be able to query the new database at any time to learn the amount and type of resources directed toward each of the PATH goals and/or strategic initiatives as described above. Such information can be used to analyze the allocation and leveraging of resources to help determine whether the existing level of coordination is sufficient or if additional needs exist. For example, the PATH Program will be able to use the database to determine the amount of public funds being directed toward PATH Goal #1 and compare the progress being made to where the initiative must be in order to achieve the goal.

III: PATH Baseline, Performance Measures, and Interim Objectives

The specific criteria for assessing progress toward achieving PATH goals are addressed by the following three subsections:

- Specific Definitions and Baseline Data for PATH Goals
- Baseline and Performance Measures by PATH Goal
- Interim Objectives

Specific Definitions for PATH Goals and Applicable Baseline Data

The President established the following broadly defined mission goals for PATH:

- Reduce the monthly cost of new housing by 20 percent or more;
- Cut the environmental impact and energy use of new housing by 50 percent or more and reduce energy use in at least 15 million existing homes by 30 percent or more;
- Improve durability and reduce maintenance costs by 50 percent; and
- Reduce by at least 10 percent the risk of loss of life, injury and property destruction from natural hazards and reduce by at least 20 percent residential construction work illness and injuries.

To establish the foundation for developing quantitative baseline and performance measures and interim objectives for PATH, the broad mission goals established by the President can be restated and more precisely defined as follows:

- Goal A: Reduce the average monthly cost of new housing built in 2010 by 20 percent or more, relative to homes built from 1990 through 1997, where this reduction in monthly housing costs reflects:
  - Goal A1: A 50 percent reduction in energy costs;
  - Goal A2: A 50 percent reduction in maintenance and replacement costs; and
  - Goal A3: At least a 10 percent reduction in construction and insurance costs.
- Goal B: Achieve safety, health, and environmental impact goals for new housing built in 2010, relative to homes built from 1990 through 1997, including:
  - Goal B1: A 50 percent reduction in environmental impact;
  - Goal B2: A 20 percent reduction in residential construction work illness and injuries; and
  - Goal B3: A 10 percent reduction in the risk of loss of life, injury and property destruction from natural hazards.
- Goal C: By 2010, reduce energy use in at least 15 million existing homes built before 1997 by 30 percent or more.

Analysis presented below shows that a 50 percent reduction in energy, maintenance, and replacement costs will reduce total monthly housing costs by about 10 percent. A 10 percent reduction in construction and insurance costs is needed to reduce monthly housing costs by another 10 percent to achieve the overall goal of a 20 percent reduction in monthly costs. Therefore, research and development of new technologies and building systems must pay particular attention to the reduction of new home construction costs to achieve the overall PATH affordability goal. The 1990-97 comparison time period for Goals A and B (for new homes built in 2010), and the focus on pre-1997 existing homes under Goal C, reflect the extent of recent data available to establish baseline measurements for the PATH goals.

Baseline and Performance Measures by PATH Goal

The PATH Baseline Data and Information Resource Guide (May 1998) provides summary data from a variety of sources, including:

- American Housing Survey (AHS)
- Residential Energy Consumption Survey (RECS)
- NAHB Builder Practices Survey
- NAHB Consumer Practices Survey
- HUD and Census survey on Characteristics of New Housing
- Other reports and data from Census, the Energy Information Administration, the Insurance Information Institute, OSHA, and the Manufactured Housing Institute

The most recent AHS and RECS data are from 1997. The AHS data for homes built from 1990 through 1997 are used to characterize the new home PATH baseline because these AHS data provide a diverse representative national sample of relatively new homes. In an effort to adjust for any anomalies in the AHS data, an average of figures from the 1995 and 1997 AHS are used in this analysis. Other data sources are used to refine and verify these AHS baseline measures for new homes. Baseline data and performance measures for the PATH existing home energy efficiency goal (Goal C) will use baseline data developed by the EPA ENERGY STAR program, but will also be verified against AHS and RECS data.

Baseline and Performance Measurement Problems and Operational Performance Measures

All of the PATH goals present complicated baseline performance and measurement issues. As explained below, the safety, health, and environmental impact measures require further analysis by FEMA, OSHA, and EPA. EPA and DOE are also responsible for developing more detailed baseline data and performance measures for the existing home energy efficiency goal.

An important baseline and performance measurement issue for the PATH affordability goal is the fact that data needed to measure the performance of new homes built after 2010 may not be available until 2012 or later. For example, AHS and RECS data for 1997 were just released at the end of 1999. Furthermore, to have a reasonable sample size for "new homes," the baseline "new home" data for PATH includes AHS data on homes built during 1990 through 1997. Also,

meaningful data on actual maintenance and replacement costs for homes built after 2010 may not be available until 2030 or later because maintenance and replacement costs are very low for new homes and begin to increase 10 to 25 years after a home is built.

Another performance measurement issue for PATH is the treatment of variables that affect monthly housing costs but are beyond the scope or the control of the PATH initiative. For example, taxes are not included in the PATH baseline for monthly housing cost. Principal and interest are included in the PATH baseline, but future housing market performance against the PATH goals will have to be measured after adjusting for changes in interest rates. Adjustments will also be needed for changes in average home size and for the variety of consumer choices that affect the price of a new home. For example, if advances in housing technology reduce the construction cost of a new starter home by 10 percent, many upper-income homebuyers may simply offset these savings by adding more luxury features to their homes. In order to measure progress against this goal, PATH will have to collect data on a wide variety of new home options, and adjust future monthly housing costs for the prevalence of each of these options.

Even if the technologies to meet all the PATH goals simultaneously were fully available today, the disaggragated and local nature of housing markets could make full market adoption by 2010 difficult. Achieving less than full market adoption, and failing to fully adjust for homebuyers offsetting PATH savings with additional new home features, could substantially increase *average* monthly housing costs (as reported in the AHS) relative to the PATH goal. Furthermore, the time delay in obtaining AHS data and the infrequency of these surveys (every two years) will not provide adequate data for monitoring annual progress toward achieving the PATH goals. For all of these reasons, the PATH initiative will also track its progress against the following two operational performance measures that can be monitored in a more continuous fashion:

- Achieve development, demonstration, and full commercial availability of housing technologies by 2010 that collectively achieve the PATH goals.
- Achieve the PATH affordability goals for more than 5 percent of homes built in 2010, targeting affordable homes for early adoption.

These two performance measures recognize the extraordinary challenge of completing both the research and development and the deployment effort needed to achieve widespread market penetration for advanced technologies in an industry as unique as residential construction. Also, these two performance measures can be completely consistent with the long-term measures based on AHS data. For example, monthly housing costs in PATH demonstration projects will be compared with the baseline of average monthly housing costs in the AHS. In the case of energy costs, the monthly costs for demonstration projects will have to be adjusted for climate and changes in energy prices before comparison with the AHS baseline for PATH. The construction costs for demonstration projects will be compared with the AHS baseline data for principal and interest payments, after adjusting for changes in interest rates and subtracting associated land costs. The future maintenance and replacement costs for PATH demonstration projects may be estimated based on technical data from multi-year aging simulations (provided by NIST or others). These estimated costs will be compared with the AHS baseline maintenance and

replacement costs for PATH affordability goals. This approach will provide more continuous monitoring of progress toward achieving the PATH affordability goals, and informing the redirection of PATH resources to best achieve those goals.

The key performance measure during the first few years of the PATH initiative will be the development, demonstration, and full commercial availability of housing technologies that collectively could achieve the PATH goal. The demonstration projects funded by PATH will be evaluated against this performance measure based on AHS data. As more housing technologies are proven to be effective in demonstration projects, and especially when the combination of proven technologies can achieve or substantially achieve the PATH goals, PATH will redirect its resources to focus more on commercial deployment. Seeking to achieve the PATH goals in just 5 % of homes built in 2010, and targeting affordable homes for early adoption, recognizes that 5% adoption would be the beginning of a process of widespread market acceptance. In addition, government partners in the PATH initiative have more influence over affordable housing (a major HUD objective) and lower-income homebuyers are less likely to offset PATH savings with other home options or additional living space.

Goal A: Reduce the Monthly Cost of New Housing Built in 2010 by 20 Percent

The baseline and performance measures for this goal are based on the 1997 and 1995 AHS, with separate measures provided for attached and detached single-family owner-occupied homes. Average monthly costs for energy in new homes (Goal A1) are based on reported costs for homes built from 1990 through 1997. Projected costs for maintenance and replacement for new homes (Goal A2) are based on reported current costs for homes built from 1950 through 1989. Other monthly housing costs for new homes (principal, interest, and insurance) are based on reported costs for homes built from 1990 through 1997. Table 1 provides some basic information about the average characteristics of attached and detached single-family owner-occupied housing units in the 1995 and 1997 American Housing Surveys.

Table 1: Characteristics of Average Single-Family Owner-Occupied Housing

Attached Homes	**1995 AHS**			**1997 AHS**		
	Pre-1950	**1950-89**	**1990-95**	**Pre-1950**	**1950-89**	**1990-97**
Monthly Utility Payment ($)	154	104	109	150	98	98
Square Footage	1,500	1,250	1,500	840	1,170	1,500
Number of Rooms	6	5	5	6	5	5
Current Market Value ($)	70,000	90,000	114,000	70,000	90,000	120,000
Detached Homes	**1995 AHS**			**1997 AHS**		
	Pre-1950	**1950-89**	**1990-95**	**Pre-1950**	**1950-89**	**1990-97**
Monthly Utility Payment ($)	143	148	143	148	150	144
Square Footage	1,800	1,800	2,100	1,800	1,800	2,100
Number of Rooms	6	6	7	6	6	7
Current Market Value ($)	75,000	100,000	140,000	80,000	105,000	150,000

Goal A1: Reduce energy use of new housing by 50 percent

Table 2 shows monthly energy costs for both attached and detached homes by year of construction, as reported in the 1995 and 1997 American Housing Surveys. Data for homes built after 1989 will be used as the baseline for the new home energy efficiency (and environmental impact) goal, but data for older housing are also shown for comparison. Before adjusting for variables beyond the control of PATH – such as energy prices, weather variations, and average home size – these data show that Goal A1 calls for a reduction in energy costs of $72 per month for new detached homes and $52 per month for new attached homes. After adjusting for home size, the goal is a reduction of 3.5 cents per square foot.

Table 2: Total Monthly Fuel Bill ($)

	Pre-1950	1950-1989	1990-97
Attached Homes	152.33	101.21	103.55
Attached Homes per square foot	0.14	0.08	0.07
Attached Homes 50% Reduction Goal	**76.17**	**50.61**	**51.77**
Detached Homes	145.59	149.00	143.50
Detached Homes per square foot	0.08	0.08	0.07
Detached Homes 50% Reduction Goal	**72.79**	**74.50**	**71.75**

* 0.5 = .035

Goal A2: Reduce maintenance and replacement costs by 50 percent

The AHS and the Census Expenditures for Residential Improvements and Repairs (C50) both report data on household expenditures for maintenance (and repairs) and for major replacements. Goal A2 will be measured against the sum of maintenance and major replacement costs. The "durability" goal is quantified by a 50% reduction in major replacements and a 50% reduction in maintenance and repair costs. Focusing on the sum of these two elements recognizes that available data may reflect some gray area in the distinction between maintenance and replacement data reporting (such as partial roof replacements). Major replacement expenditures are primarily associated with items that last for many years (HVAC units, roofs, siding, windows and doors, etc.). Therefore, the goal of reducing replacement costs by 50 percent could also be equivalent to a goal of doubling the expected useful life of these items.

Tables 3 and 4 detail the average annual maintenance and replacement costs for attached and detached homes, by year of construction, according to the 1995 and 1997 American Housing Surveys. Table 3 demonstrates that maintenance and replacement costs are approximately $245 per year for new attached homes and $578 per year for homes built between 1950 and 1989. Assuming that older home costs are more representative of future replacement and maintenance costs for new homes, PATH seeks to reduce these annual costs by approximately $289.

Table 3: Average Annual Maintenance and Replacement Costs for Attached Homes ($)

	Pre-1950	1950-1989	1990-97
Replaced/covered siding	19.44	4.80	0
Replaced internal water pipes	13.98	3.84	0
Replaced doors or windows	91.98	44.16	0.78
Replaced plumbing fixtures	15.48	7.80	0
Replaced insulation	1.26	0.12	0
Replaced finished flooring with same/different type of flooring	16.02	31.32	26.16
Replaced built-in heating equipment	59.70	22.62	6.84
Other replacements	10.86	1.14	0
Added/replaced roof	103.08	93.96	2.52
Installed/replaced central air conditioning	9.00	48.48	0.72
Added/replaced water heater	12.6	12.60	4.86
Added/replaced driveways	14.22	7.74	3.48
PATH Major Replacements	367.62	278.58	45.36
Routine Maintenance	500.04	300.00	200.04
PATH Maintenance & Replacements	**867.66**	**578.58**	**245.4**
50% Maint. and Repl. Reduction Goal	**433.83**	**289.29**	**122.7**

12 mo. = 24.11

Table 4: Average Annual Maintenance and Replacement Costs for Detached Homes ($)

	Pre-1950	1950-1989	1990-97
Replaced/covered siding	40.98	34.8	1.5
Replaced internal water pipes	11.22	7.86	3.78
Replaced doors or windows	76.86	73.02	11.16
Replaced plumbing fixtures	7.62	10.26	1.5
Replaced insulation	1.74	0.9	0.12
Replaced finished flooring with same/different type of flooring	16.2	37.08	17.76
Replaced built-in heating equipment	41.28	30.54	2.82
Other replacements	8.16	2.88	0.24
Added/replaced roof	128.04	132.6	6.84
Installed/replaced central air conditioning	50.34	75.84	15.6
Added/replaced water heater	12.36	13.68	2.22
Added/replaced driveways	34.62	37.86	56.88
PATH Major Replacements	429.42	457.32	120.42
Routine Maintenance	350.04	399.96	300
PATH Maintenance & Replacements	**779.46**	**857.28**	**420.42**
50% Maint. and Repl. Reduction Goal	**389.73**	**428.64**	**210.21**

12 mo. = 35.72

Table 4 shows that maintenance and replacement costs for new detached homes average $420 per year, and these costs are about $857 per year in older homes. Therefore, PATH seeks to reduce these costs by approximately $429 per year.

To verify the accuracy of the AHS data, 1995 and 1997 AHS costs were compared with major replacement costs in 1996 as reported in the Census C50 data. Similarly, the average of 1995 and 1997 AHS costs (the figures used in this analysis) was compared with the Census C50 data. As Table 5 demonstrates, the numbers are generally comparable – for both 1995 and 1997, all but one of the major categories of expenditures are within 15 percent of the PATH comparison numbers. These variations are expected given that the data were collected for different years and are based on different samples.

Table 5: Yearly Major Replacements Expenditures in Millions of Dollars

	PATH 1996	AHS 1995	Difference	Percent Difference
Plumbing	1,312	768	-544	-41%
HVAC	3,719	3964	245	7%
Siding	1,849	1701	-148	-8%
Roofing	5,212	5936	724	14%
Windows/Doors	4,016	3743	-273	-7%
Total	16,108	16111	3	0%
	PATH 1996	**AHS 1997**	**Difference**	**Percent Difference**
Plumbing	1,312	1,117	-195	-15%
HVAC	3,719	4,240	521	14%
Siding	1,849	1,759	-90	-5%
Roofing	5,212	7,070	1858	36%
Windows/Doors	4,016	3,659	-357	-9%
Total	16,108	17,845	1737	11%
	PATH 1996	**AHS Mean (95/97)**	**Difference**	**Percent Difference**
Plumbing	1,312	943	370	-28%
HVAC	3,719	4,102	-383	10%
Siding	1,849	1,730	119	-6%
Roofing	5,212	6,503	-1,291	25%
Windows/Doors	4,016	3,701	315	-8%
Total	16,108	16,978	-870	5%

Goal A3. Reduce construction and insurance costs by 10 percent.

The broadest overlap in the PATH goals is the overlap between reducing energy and maintenance and replacement costs by 50 percent and the goal of reducing monthly housing costs by 20 percent. Table 6 demonstrates the effect of reduced energy and maintenance and repair costs (Goals A1 and A2) on monthly housing costs for attached homes (the same data are also shown for older homes for comparison). For new homes, PATH monthly housing costs are defined as the sum of PATH principal and interest (excluding land costs), insurance, PATH maintenance and replacements, and total monthly fuel bills. PATH baseline principal and interest is equal to 75.6% of AHS principal and interest because the NAHB Construction Survey estimates that finished lot cost accounts for about 24.4% of total sales price of a single-family

home in 1995, and land costs are beyond the control of PATH. Insurance refers to the AHS monthly costs for homeowner's insurance. PATH maintenance and replacements are equal to the sum of the items detailed in Table 4 (divided by 12), and total monthly fuel costs are as shown in Table 2.

These monthly costs for new attached homes are approximately $708. PATH Goal A, then, is to decrease these costs by $142 (20 percent). If energy costs and maintenance and repair costs are each decreased by 50 percent ($52 and $10, respectively), then PATH is $62 closer to its $142 goal. As seen in Table 6, if mortgage principal and interest and insurance costs can be reduced by $80 per month (14 percent), PATH will achieve its goal of a 20 percent reduction in monthly housing costs for new attached homes.

Table 6: Monthly Housing Costs for Attached Homes by Year of Construction ($)

Option B

	Pre-1950	1950-1989	1990-1997
PATH Principal & Interest (P&I)	355.23	416.65	558.59
Insurance	34.38	26.59	25.00
PATH Maintenance & Replacements	72.31	48.22	20.45
Total Fuel Bill	152.33	101.21	103.55
PATH Monthly Housing Cost	**614.24**	**592.66**	**707.58**
	0.00	0.00	0.00
20% Reduction Goal	122.85	118.53	141.52
50% Fuel Bill Reduction Goal	76.17	50.61	51.77
50% Maint. and Repl. Reduction Goal	36.15	24.11	10.23
P&I and Insurance Reduction Goal	-10.53	43.82	79.52
-Percent of P&I	**3%**	**11%**	**14%**

Table 7 offers an alternative perspective on the PATH goal. In this analysis, Option B is identical to the analysis in Table 6 that uses maintenance and replacement costs for homes built between 1990-1997. Option A, however, uses the maintenance and replacement costs for homes built between 1950 and 1989 ($48 instead of $20) because these costs may be more representative of long-term housing costs related to durability. The net effect of this change is that, for attached homes, the 20 percent reduction in monthly housing costs can be achieved with a $71 reduction (instead of $80) in principal, interest, and insurance costs (13 percent instead of 14 percent).

mixed baseline

Table 7: Principal, Interest and Insurance Reduction Goals for Attached Homes

	Option A	Option B
PATH Monthly Housing Cost Baseline	735.35	707.58
20% Reduction Goal	147.07	141.52
50% Fuel Bill Reduction Goal	51.77	51.77
50% Maint. and Repl. Reduction Goal	24.11	10.23
P&I and Insurance Reduction Goal	71.19	79.52
-Percent of Principal & Interest	**13%**	**14%**

Tables 8 and 9 detail a similar analysis for detached homes. As Table 8 demonstrates, PATH's goal of a 20 percent reduction in housing costs for new homes translates into a $161 monthly reduction for new detached homes. If the 50 percent reductions in fuel bills and maintenance and replacement costs are achieved ($72 and $18, respectively), the 20 percent overall reduction for new detached homes can be achieved with an additional $72 reduction in principal, interest, and insurance costs. This $72 reduction is equal to approximately 12 percent of monthly principal and interest costs on a new detached home.

Table 8: Monthly Housing Costs for Detached Homes by Year of Construction ($)

	Pre-1950	1950-1989	1990-97
PATH Principal & Interest (P&I)	311.54	409.03	594.41
Insurance	29.59	33.33	34.17
PATH Maintenance & Replacements	64.96	71.44	35.04
Total Fuel Bill	145.59	149.00	143.50
PATH Monthly Housing Cost	**551.66**	**662.80**	**807.11**
20% Reduction Goal	110.33	132.56	161.42
50% Fuel Bill Reduction Goal	72.79	74.50	71.75
50% Maint. and Repl. Reduction Goal	32.48	35.72	17.52
P&I and Insurance Reduction Goal	5.06	22.34	72.15
-Percent of P&I	**2%**	**5%**	**12%**

In Table 9, Option B shows the same analysis as Table 8 that includes maintenance and replacement costs for homes built between 1990-1997, while Option A reflects maintenance and replacement costs for homes built between 1950 and 1989 to estimate long-term costs related to durability. Using these cost figures, the 20 percent reduction in monthly housing costs for new detached homes can be achieved with a $61 (instead of $72) reduction in monthly costs related to principal, interest, and insurance. This $61 reduction is approximately 10 percent of current monthly housing costs for principal and interest on a new detached home, as opposed to 12 percent for Option B.

Table 9: Principal, Interest and Insurance Reduction Goals for Detached Homes ($)

	Option A	Option B
PATH Monthly Housing Cost Baseline	843.51	807.11
20% Reduction Goal	168.70	161.42
50% Fuel Bill Reduction Goal	71.75	71.75
50% Maint. and Repl. Reduction Goal	35.72	17.52
P&I and Insurance Reduction Goal	61.23	72.15
-Percent of P&I	**10%**	**12%**

Goal B. Reduce environmental impact by 50 percent; decrease by at least 20 percent residential construction work illnesses and injuries; and reduce by at least 10 percent the risk of loss of life, injury, and property destruction from natural hazards

Achieving the PATH energy efficiency goal for new homes will have significant associated environmental benefits, by reducing carbon emissions change, and by reducing other emissions resulting from energy use. Other components of the environmental impact reduction goal identified in the compilation of PATH baseline data include:

- Water conservation;
- Construction debris; and,
- The use of recycled construction materials.

To quantify and weight each of these components to establish explicit measurement criteria for achieving an overall 50 percent reduction in environmental impact would be extremely complex. Fortunately, a number of other research and modeling efforts are beginning to address the development of such environmental measuring tools. The Green Building Council has developed the LEEDS (Leadership in Energy and Environmental Development) system to rate the environmental performance of commercial buildings, and plans to develop a residential LEEDS system soon. Meanwhile, PATH is funding NIST to work with the housing industry to utilize its BEES (Building for Environmental and Economic Sustainability) model to evaluate the life cycle, environmental, and economic performance of high-impact housing components, and begin commercializing dissemination of the results.

Over the next year, PATH will work with the housing industry and other stakeholders to develop and form consensus over a baseline and measuring tool for environmental impact. It should be noted however, that measuring energy use will also provide a major component of any environmental measure. As stated above, a reduction in energy use will result in reduced emissions that negatively impact the environment. The other environmental and health issues cited above will be monitored and considered when tracking progress on both the new and existing home goals (A1 and C), but not measured against any specific PATH goal.

As in the case of environmental impacts, some of the natural hazards addressed by PATH are major issues of concern only in specific regions (hurricanes in coastal regions, earthquakes in areas near active fault lines). The PATH baseline data show total national loss of life and monetary losses (not just residential losses) from hurricanes, earthquakes, tornadoes, and floods, and national losses from residential fires.
The 1995 and 1997 AHS provide "disaster related" as one of the explanations for housing upgrade expenditures. Additional analysis of these AHS data may be needed to identify patterns in the types of upgrades, age and income of residents, regional location, and other factors that might provide a better understanding of how to target the PATH effort related to natural hazards. Finally, to the extent that most fire losses are not really "natural" disasters, they are not included in this baseline.

Goal C: Reduce energy use in at least 15 million existing homes by 30 percent or more.

The PATH goal for existing homes is different from all the others and is treated separately. First, unlike the other goals, this goal sets specific quantitative measures- a 30% reduction in at least 15 million units. Second, this goal can be reached with technologies that are available in the marketplace. New technologies might make it possible to meet the goal earlier, or make it more affordable so that lower income families can retrofit their homes with less subsidy or assistance, but achieving this goal will primarily rely on a deployment strategy rather than R&D efforts.

Existing home energy use varies greatly by climate, region, age of housing, and other variables. The EPA ENERGY STAR Homes Program has developed a baseline analysis of the existing housing stock and key housing components (windows, HVAC, etc.) through the DOE Lawrence Berkeley National Laboratory (LBNL), and the static baseline for the PATH existing home strategy will be based on this LBNL analysis. Over the next ten years, the energy efficiency of many existing homes is expected to improve due to the replacement of older, inefficient windows, HVAC units, and appliances. The PATH existing home baseline trend, based on the LBNL ENERGY STAR baseline, will establish the following:

- The replacement rates for existing home items that significantly affect energy use
- The average age and energy use characteristics of the items replaced by 2010
- The energy use characteristics of new replacement items.

The EPA, DOE, HUD, other federal agencies, state and local agencies, utilities, local non-profit organizations, and other market transformation groups operate a variety of programs designed to improve the energy efficiency of existing homes. These programs will be catalogued and their contributions to the PATH goal will be estimated.

Federal, state and local government agencies, as well as non-profit organizations and private sector companies, also have programs to encourage the improvement of the housing stock for reasons other than energy efficiency. HUD programs such as HOME, CDBG, and the Low-Income Housing Tax Credit fund housing rehabilitation. Other HUD programs such as the Lead Hazard Abatement Program also fund home repairs and upgrades. Other agencies, such as DOD,

own housing that will need rehabilitation. Finally, the lending community has products such as the FHA 203(k) and the Fannie Mae HomeStyle rehabilitation loans designed specifically to encourage rehabilitation. Every time a home is rehabbed, repaired or remodeled, opportunities for energy improvements open up. These programs will also be catalogued and the potential contributions to identify ways to improve programs to support PATH goals.

Based on the information collected in the previous steps, EPA will estimate the additional effort needed to achieve the PATH existing home goal. PATH is committed to achieving the specific goal of improving the efficiency at least 15 million homes by 30 percent, based on all of the energy used in these homes (appliances and lighting as well as heating, cooling and hot water).

Based on this baseline trend analysis of the existing housing stock, EPA will develop a matrix to show how the implementation of the programs described above will impact different segments of the housing stock. To avoid double counting efficiency gains, each program identified will be divided into subprograms that focus on particular market segments or coordination between programs. Table 10 shows a matrix that illustrates what subprogram labels might look like, where each cell would contain the number of homes upgraded by 30 percent.

Table 10: Number of homes upgraded through PATH affiliated Programs (in thousands)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
HIP – market sales											
HUD – HOME/CDBG											
HIP – Utilities											
HIP – Fannie Mae											
HIP – State Programs											
DOE Weatherization											
ENERGY STAR HVAC not Included Above											
Total											

The matrix described above will be used to track progress toward the PATH goal for existing homes. This tracking system will also be verified against Residential Energy Consumption Survey or American Housing Survey data on residential energy consumption and expenditures.

INTERIM OBJECTIVES

Interim objectives for FY2000 and FY2001 are process-oriented, establishing the organizational structure and management procedures for PATH. After 2001, PATH expects to show steady quantifiable results with respect to the existing home goal, and measurable results with respect to technology evaluation, development, and demonstration. Quantitative measures for deployment of new home technologies that achieve the PATH goals will almost certainly need to be revised after the technology roadmapping process is further along, but the following interim objectives (through 2006) illustrate the ambitious timeline for achieving the PATH goals in 2010.

FY2000

- Develop first-year PATH operating plan
- Establish PATH Working Groups
- Identify preliminary Technology Inventory
- Initiate PATH field evaluations and national demonstration sites

FY2001

- Develop PATH strategy
- Develop second-year PATH operating plan tied to strategy
- Begin Technology Roadmapping process
- Establish cooperative research funding mechanisms
- Develop complete inventory of market-tested (cost-effective) technologies for immediate deployment
- Develop detailed implementation tactics for achieving existing home goal
- Develop feedback mechanisms to inform PATH about its early and ongoing progress.

FY2002

- Develop or identify an accepted baseline and measurement tool for environmental impact
- Expand inventory of market-tested (cost-effective) technologies.
- Reduce monthly energy ~~costs~~ use by 30 percent in 0.75 million existing homes
- Identify technologies that achieve 20 percent reduction in energy, maintenance and replacement costs
- Identify technologies and whole building reengineered designs that achieve reduced construction costs

FY2003

- Reduce monthly energy ~~costs~~ use by 30 percent in 2 million existing homes (cumulative)
- Identify technologies that achieve 30 percent reduction in energy, maintenance and replacement costs
- Identify technologies that achieve 3 percent reduction in construction costs

FY2004

- Reduce monthly energy ~~costs~~ use by 30 percent in 3 million existing homes (cumulative)
- Identify technologies that achieve 35 percent reduction in energy, maintenance and replacement costs
- Demonstrate technologies that achieve 30 percent reduction in energy, maintenance and replacement costs
- Identify technologies that achieve 6 percent reduction in construction costs

FY2005

- Reduce monthly energy costs by 30 percent in 4.2 million existing homes (cumulative)
- Identify technologies that achieve 45 percent reduction in energy, maintenance and replacement costs
- Demonstrate technologies that achieve 35 percent reduction in energy, maintenance and replacement costs
- Identify technologies that achieve 9 percent reduction in construction costs
- Demonstrate technologies that achieve 3 percent reduction in construction costs

FY2006

- Reduce monthly energy costs by 30 percent in 6 million existing homes
- Identify technologies that achieve 50 percent reduction in energy, maintenance and replacement costs
- Demonstrate technologies that achieve 40 percent reduction in energy, maintenance and replacement costs
- Identify PATH technologies that achieve 10 percent reduction in construction costs
- Demonstrate PATH technologies that achieve 6 percent reduction in construction costs

Attachment A

Attachment B

Attachment C

Attachment A: Current Members of PATH Working Groups and Committees

Industry Steering Committee

Asdal Builders	Chester, NJ
CertainTeed	Valley Forge, PA
Chapman Homes	Santa Fe, NM
G.E. Appliances	Louisville, KY
Glunt Development Co.	Turtle Creek, PA
K. Hovanian Builders	Red Bank, NJ
Masonite	Chicago, IL
National Association of Home Builders	Washington, DC
Schult Homes	Middlebury, IN
Wood Truss Council of America	Madison, WI

Finance Working Group

American Homeowner Education & Counseling Institute	Washington, DC
BBH Enterprises	Carollton, TX
Bigelow Homes	Paletine, IL
CERF	Washington, DC
Department of Energy	Washington, DC
EEMs Inc. & Company	Mountain View, CA
Environmental Protection Agency	Washington, DC
Fannie Mae	Washington, DC
FHA	Washington, DC
FHL Bank of Boston	Boston, MA
FHL Bank of Pittsburgh	Pittsburgh, PA
Freddie Mac	McLean, VA
GMAC Mortgage Corporation	Horsham, PA
Green Building Alliance	Pittsburgh, PA
HERS Council	Washington, DC
Housing and Urban Development	Washington, DC
M&T Mortgage	Clifton Park, NY
Habitat for Humanity	Washington, DC
National Association of Home Builders	Washington, DC
National Home Energy and Resources Organization	Richmond, VA
National Renewable Energy Lab	Denver, CO
North American Steel Framing Alliance	Washington, DC
People's Heritage Savings Bank	Portland, ME
Treasury Department	Washington, DC

Barriers and Insurance Working Group

Andersen Corporation	Bayport, MN
Armstrong World Industries	Lancaster, PA
Institute for Business and Home Safety (IBHS)	Boston, MA
International Code Council	Falls Church, VA
National Steel Framing Alliance	Washington, DC

NES Building Innovation Center	Birmingham, AL
State Farm Insurance Companies	Bloomington, IL
Studor Incorporated	Dunedin, FL
USAA	Norfolk, VA
Rosengarten Companies	Perth Amboy, NJ
National Evaluation Service, Inc.	Falls Church, VA
Piper & Marbury	Washington, DC
CERF	Washington, DC
Charles Pankow Builders	San Francisco, CA
Zurich Group	Baltimore, MD
Coventry Homes, Inc.	Fort Meyers , Fl
Allstate Insurance Company	Northbrook, IL

Technology Working Group

Alpine Engineered Products	Earth City, MO
Anderson Corporation	Lancaster, PA
AutoDesk Inc.	San Rafael, CA
Carrier	Syracuse, NY
Centex Homes	Dallas, TX
Champion Enterprises, Inc.	Auburn Hills, MI
Crest Homes	
G.E. Appliances	Louisville, KY
Habitat for Humanity	Washington, DC
Honeywell	Minneapolis, MN
IBACOS	Pittsburgh, PA
IBM Home Marketing	Research, Triangle, NC
International Code Council	Falls Church, VA
K. Hovnanian	Red Bank, NJ
Kohler	Kohler, WI
Louisana Pacific	Portland, OR
Miller Construction	Tucson, AZ
National Institute of Standards and Technology	Rockville, MD
Oakwood Homes	Engelwood, CO
Owens Corning	Toledo, OH
Southern California Edison	Rosemead, CA
Square D or Cutler_Hammer	
Superior Walls	New Holland, PA
The Dow Chemical Company	Midland, MI
TLC Builders Inc.	
True House	
Trussway	
University Consortium	
USG	Chicago, IL
Weyerhauser	Tacoma, WA
Wickes Lumber	

Quality and Labor

Alpine Engineered Products, Inc.	Earth City, MO
Armstrong World Industries	Lancaster, PA
Asdal Builders, LLC	Chester, NJ
Black & Decker (U.S.), Inc.	Towson, MD
Canadian Wood Council	Ottowa, ON
Centex Homes	Carrollton, TX
CertainTeed Corporation	Valley Forge, PA
Clearwater Group	Raleigh, NC
Croscan Brookfield	Vienna, VA
Del Webb Corporation	Phoenix, AZ
Delcor Homes	Milford, MI
Home Builders Institute	Washington, DC
K. Hovnanian Companies Northeast, Inc.	Red Bank, NJ
Kennedy Community Development	East Dundee, IL
Louisiana Pacific Corporation	Portland, OR
National Association of Home Builders	Washington, DC
Neumann Homes	Warrenville, IL
North American Steel Framing Alliance	Washington, DC
NRS Consumer Research	Madison, WI
Oakwood Homes	Englewood, CO
Schuck and Sons Construction Company, Inc.	Glendale, AZ
Schlage Lock	Dallas, TX
Seaboard Builders	Annapolis, MD
Shea Homes	San Diego, CA
Sunrise Colony Company	Houston, TX
The Estridge Company	Carmel, IN
Thompson Homes, Incorporate	Owensboro, KY
Triple Crown Corporation	Harrisburg, PA
U.S. Department of Housing and Urban Development	Washington, DC
U.S. Home Corporation	Houston, TX
United States Gypsum Corporation	Chicago, IL
Winchester Homes	Greenbelt, MD
Wood-Truss Council of America	Madison, WI
Professional Builder	Des Plaines, IL
Tucson Electric Power Company	Tucson, AZ
Triple Crown Corporation	Harrisburg, PA

Consumer Education

ACEEE	Washington, DC
Alliance to Save Energy	Washington, DC
Andersen	Bayport, MN
Arizona State University	
Automated Builder	
Better Homes and Garden	Des Moines, IA
Builder Magazine	
Cornell University	Ithaca, NY

EESI	
Home Depot	Atlanta, GA
HomeownerNet	
Honeywell	Minneapolis, MN
IBACOS	Pittsburgh, PA
IBM Home Networking	Research Triangle, NC
Iowa State University	Ames, IA
Island Preservation Partnership	Dewes Island, SC
Ladies Home Journal	
League of California Homeowners	
National Evaluation Service Building Innovation Center	Birmingham, AL
National Association of Realtors	Washington, DC
North Carolina A&T	
Oak Ridge National Laboratory	Oakridge, TN
Owens Corning	Toledo, OH
Pasadena Homes, Inc.	Pembroke Pines, FL
Portland Cement Association	Skokie, IL
Professional Builder Magazine	
Rutgers Cooperative Extension	
South County Housing	
Southface Energy Institute	Atlanta, GA
This Old House	
University of Georgia	Athens, GA
U.S. Green Building Council	San Francisco, CA
Utah State	

Attachment B

Attachment C

Attachment B: FY 2000 PATH Operating Plan

The PATH Operating Plan , which follows, details the many activities that are underway as part of, or in support of, the overall PATH Strategy. There is much of which to be proud. Some of the accomplishments include:

- Developing an inventory of almost two hundred existing technologies that can significantly contribute to PATH goals;
- Initiating, with industry, a comprehensive technology roadmapping process to identify technological needs and potential solutions that can meet PATH goals;
- Establishing, for the very first time, a comprehensive technology information dissemination system . Working through both the industry-sponsored ***ToolBase*** program and PATH's own website (**www.pathnet.org**), thousands of builders, non-profits, and others are now obtaining the latest technical information on new and innovative technologies;
- Jointly with the National Science Foundation, funding our nation's universities and colleges for a range of fundamental research projects aimed at the PATH goals;
- Assisting industry in cooperative research projects aimed at developing new building products and systems; and,
- Testing and evaluating innovative products in a series of field evaluation and demonstrations with builders, non-profits and community groups in various sites across the nation.

In order to capture the breadth of PATH activities, the Operating Plan is organized in a format structured to provide all the requisite details. The Plan is composed of two distinct parts: 1) a description of the activities underway in the year 2000, and 2) a status report on the activities identified in the 1999 Operating Plan (Attachment C).

The description of PATH activities underway in the **FY 2000 Operating Plan** has been re-designed to follow and track the individual activities as they relate to the 2000 PATH Strategic Plan. The 2000 PATH Operating Plan includes columns describing:

A. The **Primary PATH Goal** addressed by each activity
B. The **Primary Strategic Initiative** addressed by each activity
C. The Primary PATH Partner for each activity
D. The Secondary PATH Partner for each activity
E. The Activity description
F. The Date Initiated for each activity
G. The Milestone End Date for each activity (as identified in 2000)
H. The Status & Plans for each activity (as identified in 2000)
I. Performance Measures

The Performance Measure Column in the FY2000 PATH Operating Plan is composed of 9 possible categories which identify the types of products that result from the PATH Actions. The following is a key describing the categories that are represented in the column.

#	Category Name	Description
1	Production of Reports	• Actions that produce PATH Working Group "white papers", or published research Actions that are responsible for developing protocols, research methodologies and preliminary plans for projects • Actions that result in products such as guidebooks for builders and HUD staff
2	Construction of Demonstration Sites	• Actions that involve that actual construction of various demonstration sites around the country to test new technologies and products
3	Production of Products	• Actions that produce CD-ROMs, websites and other software systems that are used to disseminate information about new technologies and success stories
4	Development of Technology	• Actions that result in the research, development and implementation of new technologies for housing.
5	Conducting Training/Conferences	• Actions that lead to trainings for builders and to conferences for the PATH partners
6	Providing Grants/Funds	• Actions that provide leveraged funds (e.g. awards and grants) to private industry partners, universities, and research centers to conduct research and development of new technologies and products needs for PATH goals.
7	Collection of Data	• Actions that involve collection of data necessary for analysis and assessment of programs • Data collection through the ToolBase Hotline, and database systems
8	Community Outreach	• Actions that promote PATH goals through various agencies • Dissemination of information and ideas regarding the PATH program between federal agencies, industry partners and the general public • Strengthen the partnership with industry leaders
9	Development of Evaluation Plans	• Actions that involve the development of evaluation criteria, and produce plans to assess the effectiveness of the program activity and goals.

FY 2000 PATH Operating Plan

Primary PATH Goal	Primary PATH Partner	Secondary PATH Partner	Activity	Date Initiated	Milestone End Date	Status & Plans (2000)	Performance Measures
A1	DOC/NIST	HUD	In cooperation with the model codes and the National Evaluation Service's Building Innovation Center (NES-BIC), develop evaluation plans for at least 10 emerging technologies and complete the comprehensive evaluation of at least one technology.	Jun-99	Ongoing	Supplemental Evaluation Fee Program announced with a limited response from industry. Strategic alternatives are being examined.	11
A1	DOC/NIST	HUD	In conjunction with the NES-BIC, plan and develop a generic evaluation plan for the same type technology.	Jun-99	Oct-00	NES-BIC developing evaluation criteria for ICF, and developing evaluation criteria for three initial technologies.	11
A1	HUD		Apply evaluation criteria to the 200 technologies that have been identified by the program. Select technologies for demonstration and field evaluations.	Sep-99	Ongoing	Over 150 technologies are listed. Each technology identified on quality of data and degree of development. Over 20 technologies are being tested in field evaluations and demonstrations. Items with the highest priority are proceeding through the evaluation process.	4
A1	PATH/HUD		Identify at least 150 emerging technologies that could help the building industry to accomplish the PATH goals.	Feb-99	On-going	PATH web site established (www.pathnet.org). PATH and ToolBase websites provide a technology inventory, demonstration, and a field evaluation database. PATH web site fully operational (www.pathnet.org). PATH and ToolBase websites provide a technology inventory in over 150 products. At least 25 additional products to be added in FY 2000.	3
A1	DOC/NIST	HUD/DOE/FPL	Provide leveraged cooperative research and development grants to industry, based on a competitive program addressing high priority technology needs relating to the tough PATH performance and cost goals.	Oct-99	Dec-00	Additional funds to be transferred to NIST to fund additional PATHCoRP projects. Existing cooperative agreements continue with DOW, MADE, Manufactured Housing Research Alliance, and Wood Truss Council. PATHCorp adds at least 8 additional cooperative agreements.	6
A1	DOC/NIST	HUD	Durability research data to be produced in Computer Integrated Knowledge Systems		Oct-00	Durability research program planning has been initiated.	7
A1	DOE		Building America will develop documentation on cost and performance.		Jun-99	Documentation is underway.	1
A1	DOE		Transfer lessons learned from Building America projects to PATH evaluation activities.		Apr-99	No action yet.	11

A1	EPA		Develop an OMB-approved study design by July 1999 for evaluating the cost and performance attributes of a statistical sampling of homes built under the Energy Star homes program and begin the evaluation process by September 1999.		Jul-99	Plan was submitted to OMB for approval.	1
A1	HUD	DOE/DOC	Obtain R&D investment commitments from 15 industry partners by 12/30/00 totaling $6 million dedicated to the achievement of PATH goals.	Mar-99	Dec-00	Will award 5-10 grants in FY00.	6
A1	HUD	DOE	Develop with industry, a technology roadmap that outlines the best opportunities and potential technological developments that are necessary by both government and industry in order to meet PATH goals by 2010.	Jan-00	May-00	Technology Roadmapping group will have an initial plan for 10 major opportunities available by late spring 2000.	4
A1	HUD	DOC	Conduct cooperative R&D with industry partners.	Apr-99	On-going	Cooperative R&D projects with DOW and Wood Truss Council of America were initiated in 4/99. Conduct research with NAHB in improving engineering performance and affordability of wood structures. Cooperative research initiative launched with Manufactured Housing Alliance to develop steel applications and installation techniques. Research with Manufactured Housing Research Alliance now fully underway.	4
A1	HUD		Develop procedure for evaluating the performance of PATH demonstrations and field tests.	Apr-99	Apr-99	Procedure for documenting performance evaluations created.	11
A1	HUD		Investigate options for manufacturing housing components and sub-systems which assemble easily on the job site, utilize low-cost, flexible manufacturing techniques, yet maintain high standards for precision and reliability.	Jun-99	Sep-99	Research with VPI to enter second phase. Initiate a demonstration with at least one builder to apply information technologies to management of production system.	2
A1	HUD/PATH		Challenge industry to invest in R&D at a National PATH Summit.	Mar-99	Sep-00	National Summit planned for September 28-9, 2000 in Washington, D.C.	10
A1	HUD/PATH/DOE		Initiate technology roadmapping process with industry to develop best options and process for technology investments needed to meet PATH goals.	Jan-00	Jan-00	Industry steering committee meets, endorses roadmapping strategy. Roadmapping group will meet March 7-8 in Kansas City. By summer of FY2000 initial roadmapping complete. By end of FY2000, at least 5 new cooperative research efforts start implementation based upon roadmapping.	7

A1	HUD/PATH/DOE/ EPA		Establish government/industry working groups to address major PATH issues on: financing, barriers, consumer, technology, quality, and labor.	Jun-99	Sep-99	Six working groups are fully established, Technology working group to will have an initial roadmap set. Liability plan developed and presented for legislative consideration. Data begins to be collected on insurance rates and building performance.	8
A1	NSF/HUD		Working together with the National Science Foundation (NSF), establish a residential buildings research program and award at least 25 grants to universities for basic research addressing PATH goals.		Oct-00	NSF is in the process of selecting awardees from the first solicitation in which over 85 applications were received. Second solicitation planned for Fall 2000.	6
A1	DOC/NIST	HUD	Fully establish, jointly with the three model code organizations, a National Evaluation Service Building Innovation Center and start the evaluation of at least 10 ten innovative technologies. In cooperation with the model codes and the National Evaluation Service's Building Innovation Center (NES-BIC), develop evaluation plans for at least 10 emerging technologies and complete the comprehensive evaluation of at least one technology. In conjunction with the NES-BIC, plan and develop a generic evaluation plan for same type technology.	Jun-99	Dec-99	The National Evaluation Service has received PATH funds to conduct these evaluations. NES-Building Innovation Center is established and operational. Reviewing both generic and proprietary products. Working with NIST on durability protocol. NES-BIC to complete evaluation criteria for ICF's, NES-BIC to complete evaluation criteria for at least 5 technologies at end of FY00. With planning for 5 additional technologies. At least two technologies to undergo full product evaluation by end of year.	11
A1	DOC/NIST		Conduct laboratory testing on affordable, durable technologies.		On-going	NIST is conducting laboratory tests aimed at developing performance metrics.	4
A1	DOC/NIST		Refine test method to measure the thermal conductivity of vacuum insulation panels.		Nov-00	Research is underway	4
A1	DOC/NIST	HUD	Develop protocols for evaluating emerging technologies			Durability protocol under development.	11
A1	HUD/DOE		Initiate broad based technical assistance to at least five national pilot projects focusing on the PATH affordability goal.	Apr-99	on-going	HUD is transferring funding to DOE to support the broadening of technical assistance for the national pilots. DOE through NREL providing technical assistance to National pilots.	5
A1	USDA/FS		Develop shear design criteria to support allowable stress design and reliability-based design building codes.		Oct-00	$500K IAA with Forest Products Laboratory for research on wind resistance and durability of wood products. Work in progress with $20K of USDA/FS funding.	1
A1	DOE		Expand Building America to include over 100 industry members, indirectly transferring innovations to 150,000 production homes.		Sep-00	Over 70 industry members are participating in the program to date. There is no estimate yet on impact on housing production.	8

A1	DOE	HUD	Expand federal participation in the PATH pilot projects to include all participating federal agencies.		Apr-99	HUD is issuing an Inter Agency Agreement with DOE to expand the federal role in each of the five National Pilot projects. done	8
A1	DOE (lead)		Expand federal participation in the PATH pilot projects to include all participating federal agencies.		Apr-99	April 6 meeting between five National Pilot project teams and nine participating federal agencies held to broaden pilot projects to address all PATH goals.	8
A1	HUD		Provide technical assistance to firms who are developing products relating to the PATH goals.	Jun-99	Sep-99	NAHB Research Center is conducting research with home builders on three projects to improve the cost-effectiveness of steel, and other lumber saving technologies.	5
A1	EPA/DOE/PATH		See item 5 above.		Dec-99	See item 5 above. PATH sponsoring second annual Green Building Conference in April 2000. "Developing Green Builder Programs" is available at the Smart Growth website.	5
A1	HUD		Initiate PATH demonstrations with two HOPE VI sites.	Jun-99	Jun-00	HOPE VI Holyoke, MA: Holyoke Housing Authority Churchill Homes Project chosen for demonstration. Construction documents to be completed around third week in March. HHA will advertise for construction bids.	2
A1	HUD		Select two CPD programs to initiate PATH demonstrations		Jun-00	Discussions under way for second Hope VI with local Youthbuild programs. Discussions also begun for working with CDBG and HOME programs.	2
A1	HUD		Initiate PATH demonstrations with at least 2 Indian tribes. As part of this effort build at least 50 homes at Pine Ridge that use PATH technologies.	Jun-99	PATH role complete	PATH role at Pine Ridge complete, report being prepared. No additional sites have been selected to date.	2
A1	HUD		Build a set of four Marketable Affordable Durable and Entry-Level (MADE) homes in a model subdivision and evaluate cost, performance and marketability of this concept.	Jul-99	Sep-99	Construction to start summer of 2000. Completion by late fall. Consumer reactions and evaluations by spring 2001.	2
A1	HUD		Demonstrate Nationally Applicable Recommended Rehabilitation Provisions (NARRP) in at least 2 communities and have NARRP included in the International Residential Code published by the International Code Council (ICC).	Sep-99	Sep-99	Assist State of Maryland after enactment of NARRP. Work with Conference of Mayors and L of Cities and identify at least three other states and or localities and work on adoption.	2

A1	HUD	DOE	Develop a series of demonstration projects with builders and nonprofits on PATH technologies.	Sep-99	Sep-99	Expect at least thirty builders and nonprofit developers have committed to conduct demonstrations on projects incorporating technologies identified by the PATH program by the end of FY2000. Anticipate at least 5 additional groundbreakings and at least 5 completions during calendar year with evaluation report.	2
A1	HUD		Develop process for evaluating performance of a limited number of applications of new technologies prior to their widespread adoption.	Jun-99	Jun-99	Performance evaluation plans have been developed for technologies being used in the NAHB Research Center demonstration projects.	11
A1	DOC/NIST	HUD	Develop a system of attribute based, performance standard guides for the specification and evaluation of one-and two-family dwelling units and support related research and application activities. Refine draft guides on structural safety and serviceability, functionality, durability, indoor atmosphere, acoustics and economics as components of performance standards for housing.		Ongoing	Work is proceeding with ASTM E6.66 using both HUD and NIST funding	1
A1	DOE		Develop and implement training programs for builders for delivery in twenty communities in FY99 enabling them to take maximum advantage of new energy efficient technologies.		Jun-99	Advanced technology builder training being conducted by NAHB Research Center for DOE.	5
A1	EPA	HUD/DOE	Develop marketing tools for builders to promote PATH technology and homes.		Sep-99	Activities are underway.	8
A1	HUD		Establish a new building technology dissemination program specifically targeted to HUD grantees, non-profits and housing authorities.	Mar-99	5/15/1999 - 5/30/99	Plan completed & implementation to begin summer of FY2000. PATHways tailored to non-profit community, Energy Resources Desk Guide for HUD Staff to be published by summer 2000 Expanded PATH participation in HUD Best practices conference. Structured outreach program to HUD program participants implemented. Additional materials relevant to HUD program participants to be added to PATHnet website by fall 2000.	1
A1	HUD	DOE/EPA	Develop publication on "Energy Resources for HUD Staff"	Jun-99	Jun-00	Complete. Next stage, put on web & publish.	1

A1	HUD	DOE	Establish ToolBase as the primary source of reliable technical information for the housing industry by providing a toll-free technical hotline, a technical newsletter quarterly, a comprehensive Catalog of Building Products and Services published on CD-ROM and Internet, a LISTSERVE that is a technical web site with useful technical information on emerging home building technologies.	Mar-99	Mar-99	ToolBase expanding and fully operational. The technical hotline fields over 8,000 calls annually from builders and remodeler including a Spanish language capability. Outreach tools include a quarterly CD-ROM, a technical web site, and a quarterly technical newsletter distributed to 70,000 firms, and a ListServe. Periodic forums are held with builders and manufacturers to discuss pressing issues in the industry.	3
A1	HUD/PATH		The PATH program will develop and implement a communications plan which will focus on delivering information on program activities and results to the industry trade press and the general media. The program will coordinate the communications activities of the various partners in PATH.	Mar-99	Apr-99	PATH has created a full service web site at www.pathnet.org to provide information on the program's activities and a newsletter is under development.	8
A1	HUD/PATH		Promote outreach through industry venues including conferences, periodicals, and existing home builder programs.	Jun-00	On-going	PATH is exhibiting at the Green Builders Conference, NAHB Show, and the Remodelers Show.	8
A1	HUD/PATH		Recognize innovative applications of new technologies through Secretarial awards.	Mar-99	Mar-00	Third annual Secretary's awards with Professional Builder held. Other awards with American Planning Association, National Trust for Historic Preservation and AIA awarded during FY200.	6
A1	HUD		Track and evaluate emerging technologies and alternative materials for their potential to reduce housing costs (first and life cycle costs). Evaluate emerging technologies for their potential to reduce home energy use without raising costs or negatively impacting durability or indoor air quality.	Mar-99	Jun-99	Both PATHnet and ToolBase web sites established. PATHnet web site being re-designed. PATH demonstrations featured at Best Practices conference. The publication, "PATH Energy Desk Book for HUD Programs," is in final draft and will be ready for distribution following graphics enhancement. Both PATHnet and ToolBase websites operational, well recognized & widely used.	1
A1	HUD	DOC	Document the experiences of communities that have undergone "regulatory streamlining" processes in conjunction with HUD and the National Conference of States on Building Codes and Standards (NCSBCS).	Apr-99	Apr-99	Web site on-line citing 100 case studies. A National Conference on Regulatory Streamlining is planned by NCSBCS for April in Virginia. Conference held in San Antonio	1

A1	DOE		Conduct an evaluation and document the cost and performance results of the projects funded under the Building America program.		Sep-99	No action yet.	11
A1	DOE		Provide grants to States to weatherize 76,340 homes in FY2000, 74,000 in FY2001, and 304,000 in FY 2002-2005		FY2000-FY2005	The target for FY2000 is currently being accomplished For FY2001, appropriations will be able to address this target by the milestone end date.	6
A1	EPA		The ENERGY STAR Homes Program will have 15,000 ENERGY STAR Homes constructed during 1999.		Dec-99	Energy Star Homes program is on target to reach 15,000 homes during 1999.	2
A1	EPA		EPA's ENERGY STAR Home's builder recruitment program will incorporate the PATH initiative in all builder presentations by July, 1999.		Jun-99	Underway	8
A1	DOC/NIST	HUD	In order to maintain stakeholder involvement captured through the Partnership for Building Innovation (PBI) and PATH, NES-BIC will develop an enhanced website. The enhanced site will not only provide general information and status reports on the latest NES-BIC projects, it will serve as a media for communications between members of expert panels, staff, and applicants. NIST will provide oversight of this effort.			Project to be initiated in FY00	3
A1	DOE		Complete PATH Duct Sealing Demonstration Project and prepare a report that may be used to extend the use of this technology to other low income homes in the WAP.		Dec-00	Currently, the project is being finished up. Training has been conducted and homes in 5 states have been built. Have collected data on the project and a report is expected by Sept. 2000.	1
A1	DOE		Complete the residential buildings road map in collaboration with PATH.		Dec-00	Two meetings have occurred and conference calls are being conducted in conjunction with established working groups.	1
A1	HUD		Identify & disseminate "best practices" of exemplary efforts in technology and land use		on-going	At least 10 major additional best practices to be added to websites. Case studies on at least one national pilot produced.	1
A2	DOC/NIST		Initiate research to reduce the time to measure the photo-degradation of paints.		On-going	Work being conducted through NIST's coatings research program.	4
A2	DOE		Prepare a "white paper" on the role of home automation systems to address PATH goals relating to energy and environmental efficiency, cost, maintenance and repair.		Sep-99	Not yet started.	1

A2	USDA/FS		Conduct research on durability of building material adhesives, material properties of composites under cyclic temperature and humidity conditions, durability of water-borne, water-repellent preservatives and other low VOC water-repellent finishes.		Sep-00	$500K IAA with Forest Products Laboratory for research on wind resistance and durability of wood products.	4
A2	USDA/FS		Conduct research on durability of building material adhesives, material properties of composites under cyclic temperature and humidity conditions, durability of water-borne, water-repellent preservatives and other low VOC water-repellent finishes.		On-going	Work in progress with $105K of USDA/FS funding.	4
A2	HUD		Analyze problems and issues that have been raised by builders and remodelers placing calls to the ToolBase Hotline.		Sep-00	A system is in place whereby the ToolBase database is reviewed on a quarterly basis to continue to identify durability problems. Analysis I underway	7
A2	USDA/FS		With other PATH partners, university and industry researchers, USDA Forest Service will continue distribution of research findings and conduct a conference/workshop on durability issues in housing.		Fall, 1999	Work in progress at USDA/FS	5
A2	DOC/NIST		Develop draft housing durability/service life prediction protocol for use by NES-BIC and others.		Mar-00	Completed - 3/31/00	1
A2	DOE		Recognize innovative home building and remodeling processes through awards programs.	Apr-99	On-going	Providing PATH awards to major new projects. Continue National Housing Quality, National Remodeling Quality, and Energy Value Housing Awards given annually to innovative building firms. Add additional awards with other national organizations	6
A2	HUD		Distribute technical information to university based housing research centers.		On-going	NAHB Research Center is working closely with the 18 member Consortium of University-Based Housing Research Centers to disseminate research findings among consortium members and the building industry.	8
A2	DOC/NIST	HUD/FPL	Develop an improved, scientifically-based protocol for estimating the service life of residential sealants through improved accelerated aging tests and improved linkages between accelerated aging and field exposure experiments.			Project to be initiated in FY00	1

A2	DOC/NIST	HUD	Develop a laboratory protocol for evaluating the durability of steep-sloped roof coverings from short-term tests incorporating the effects of environmental stress factors on degradation.			Project to be initiated in FY00	1
A3	HUD		Conduct a research needs assessment for alternative materials use in housing.	Apr-99		NAHB Research Center to conduct work in this area. Work underway	4
A3	PATH/HUD		Begin evaluations of technology and construction process options that can improve disaster resistance.	Jul-99	Jul-99	HUD and FEMA expect to have a disaster resistant demonstration in Southern Florida announced by Summer FY2000.	2
A3	USDA/FPL		Begin work on a research needs assessment for wood product use in housing -- conducted in cooperation with university and industry researchers.		Dec-99	Work in progress at USDA/FS.	4
A3	DOC/NIST	HUD	Identify generic technology and 10 products for further evaluation.		Jun-00	NES-BIC is working on this.	3
A3	HUD		Conduct field testing on specific technologies.	Mar-99	On-going	NAHBRC is conducting field evaluations.	11
A3	HUD		Begin evaluations of technology and construction process options that can improve construction durability.	Jul-99	Ongoing	Over 150 technologies have been included in the PATH technology inventory. An evaluation procedure was developed using building industry input for initial screening. Up to 12 promising technologies will be evaluated in the field by builders this summer.	4
A3	HUD/DOE		Continue to develop and demonstrate new technologies such as residential fuel cells and advanced windows that have residential housing applications.		On-going	NAHB Research Center is conducting multiple demonstrations of ICFs, ACC, composite materials, and other technologies.	4
A3	USDA	HUD	HUD is issuing a Task Order to study market potential of deconstructed materials. Work to begin in June 1999. Work is underway. HUD/PATH supporting GreenBuilder Conf. Green Building strategy development is underway.		Sep-00	HUD has issued an IAA to the Forest Products Laboratory to create a rating system for deconstructed lumber.	1
A3	USDA/FS		Develop test methods and evaluation procedures for wood-based building materials for more efficient code approval and acceptance.		On-going	Field testing of technologies meeting PATH evaluation criteria underway with five builders.	11
A3	USDA/FS		Develop test methods and evaluation procedures for wood-based building materials for more efficient code approval and acceptance.		Oct-00	Work in progress with $15K of USDA/FS funding.	11

A3	USDA/FS		Assess performance of housing insulation systems for energy efficiency, moisture movement and durability.		On-going	Work in progress with $45K of USDA/FS funding.	11
A3	USDA/FS		Evaluate mechanical properties of treated lumber under conditions of high temperature and humidity.		Oct-00	Work in progress with $25K of USDA/FS funding.	4
A3	USDA/FS		Evaluate the durability of reinforced glulam beams.		Oct-00	Work in progress with $25K of USDA/FS funding.	4
A3	DOE		Develop and disseminate computer software which enables simplified compliance with building codes.		Apr-99	Software entitled "MEC-CHECK" is available.	3
A3	DOE		Develop improved computer tool to help building designers include energy efficiency options in multi-family buildings.		Sep-99	Work in progress.	3
A3	HUD		Select second Indian tribe for demonstrations.	Mar-00		Discussions underway with second tribe.	2
A3	HUD		Select at least two other lower-income projects for PATH demonstrations.	Oct-99		Efforts to find Public Housing Modernization (Capital Improvements) program have not yet produced a suitable demonstration. Expect to have at least one project. HUD SuperNOFA explicitly seeks out PATH projects. Expect to select at least three projects for PATH demonstrations.	2
A3	HUD		Demonstrate the "Next Generation" Manufactured home in 3 developments with at least one manufacturer adding the "next generation home" to their product line.	Sep-99	Sep-99	Start construction of "next generation" in Del Rio, Texas during FY 2000. Have Next Generation "home at 2001 Builders Show in Dallas. Complete and publish a report on Danbury demonstration. Identify and initiate at least one additional demonstration site.	2
A3	HUD		Develop and build both site-built and manufactured homes that meet multiple PATH goals.	Sep-99	Sep-00	MADE home construction to start summer of 2000. Completion by late fall. Consumer reaction and evaluations spring 2001.	2
A3	PATH/EPA		Work on the Green Builder Model Program and the National Green Builder Conference scheduled for April 1999.		Dec-99	NAHB Research Center has developed a Model Green Builder Program and is producing an electronic model for easier use by builders/designers.	5
A3	PATH/EPA/DOE		Assist ten communities to institutionalize green building and energy efficient building technologies.			PATH developing own GreenBuilder initiative.	8
A3	HUD		Hold a series of hands-on laboratories with Fannie Mae and Builder magazine to recognize exemplary applications of technology and educate builders.	Apr-00	May-00	First laboratory scheduled for May 2000. National PATH summit scheduled for September 2000.	5

A3	HUD	FEMA	In conjunction with the insurance industry, study practical options (including new test methods, product certifications, and demonstrations of innovative insurance rate structures) for reducing risk and, therefore, home insurance rates through the use of innovative new products and building processes.	Jun-99	Sep-99	Publish the completed paper on insurance. Initiate meetings within HUD, FEMA & OMB to discuss need and methods for collecting data on building performance. Meet with insurance industry to design program with "technology bundles " sufficient to justify rate reduction. Explore combining rate reduction with a PATH demonstration .	1
A3	HUD/DOC/NIST		Analyze problems and issues that have been raised by builders and remodelers placing calls to the ToolBase Hotline.		Jun-99	A system is in place whereby the ToolBase database is reviewed on a quarterly basis to continue to identify durability problems. Analysis is underway.	7
A3	DOC/NIST	HUD	Develop methodologies for predicting and evaluating the structural performance of single family dwellings with traditional and non-traditional construction materials. (5/00) Complete detailed and simplified finite element analysis of wall-to-foundation intercomponent connections. Issue a report. (2001) Develop, refine, and verify 3-D finite element models of typical houses.		Jun-05	Analytical work and laboratory testing underway	11
A3	DOC/NIST	HUD	Develop and implement a methodology for measuring the environmental and economic performance of residential building products. (12/00) Complete economic model for selecting residential building products.		Dec-00	Project to be initiated in FY00	1
A3	EPA	NAHB Research Center	Work on the Green Builder Model Program and the National Green Builder Conference scheduled for April 2000.	Jul-97	Apr-00	Completed one conference April 99, and developed a review of six defferent Green Building Programs and guide was distributed to Home builders. Planning additional Green building. Plan on working with additional green building outreach.	5
A3	FEMA		Update construction guidelines for manufactured home foundations.		Ongoing	PATH is still awaiting information from FEMA	1
A3	FEMA		Develop a coastal construction guide for homebuilders.		Ongoing	PATH is still awaiting information from FEMA	1

B1	EPA/PATH		EPA's ENERGY STAR Homes Program, in conjunction with other offices within EPA, will establish an environmental baseline by July, 2000.		Jun-00	No action yet.	1
B1	USDA/ CSREES		The USDA Cooperative State Research, Education and Extension Service (CSREES) will conduct outreach activities in "green" construction, environmental landscape management, and the energy and environmental advantages of using new technologies.		Sep-99	Activities are underway.	8
B1	USDA/FS		Continue evaluation of VOC emissions from particleboard and MDF.			Work in progress with $40K of USDA/FS funding.	11
B1	EPA/DOE		Provide technical documentation of Building America program results to include in the EPA ENERGY STAR Homes program.		Jun-99	NAHB Research Center is producing a guidebook based in part on Building America results showing successful ways to put ducts into conditioned space.	1
B1	HUD/EPA		Develop the preliminary plan for a Healthy Homes Initiative and submit to Congress.	Apr-99	Apr-99	Plan submitted to Congress.	1
B2	DOL/OSHA		The train-the-trainer construction outreach program organizations include construction trade unions, construction associations, and insurance companies.		Sep-00	The train-the-trainer construction outreach programs will continue through 9/2000. Train-the-trainer materials are under development by NAHB Research Center. Train-the -trainer sessions was held during the summer of 1999.	5
B2	DOL/OSHA		Provide expert assistance to small and medium employers, including residential contractors and other employers with no more than 250 employees (OSHA).		Sep-99	Over 3,000 consultation site visits were completed in FY98. A larger number of consultations are projected for FY99.	5
B2	HUD		Develop and build both site-built and manufactured homes that meet multiple PATH goals.	Jun-99	Sep-00	Construction on 4 Marketable, Affordable, Durable, Entry-Level (MADE) homes is scheduled to begin this summer outside of Washington, DC.	2
B2	DOL/OSHA		OSHA will continue developing and delivering safety and health information through its web site, the OSHA CD-ROM, Compliance Advisors Software, and the Job Safety and Health Quarterly.		Ongoing	OHSA is continually updating and revising information.	5

B2	DOL/OSHA		Disseminate the Jobsite Safety Handbook for small contractors, jointly produced by OSHA and NAHB, the Construction Regulations for the Home Building Industry manual, pocket cards on OSHA requirements for use in the field by supervisors and workers, and Fatal Facts and hazard information bulletins to alert home builders to hazards.		Jun-00	Publications will be updated, improved, and published in Spanish for further dissemination. The Handbook and other OSHA safety materials were added to the Catalog of Building Products that is distributed on CD-ROM and the Internet. The CD-ROM version is provided to all seminar attendees.	3
B2	DOL/OSHA		Continue implementing the HomeSafe Partnership with the Home Builders Association of Metropolitan Denver. The Partnership has a ten point program based on actual accident experience to address specific hazards causing fatal and serious accidents and a design solution for managing the risks inherent in the residential home building industry (OSHA).		Ongoing	Program is up and running. Additional partnerships are under development.	5
B2	DOL/OSHA		Develop a focused inspections guidance document for the construction industry (OSHA).		Ongoing	Application of the document by the construction industry is ongoing. Work is underway.	1
B2	DOL/OSHA		Develop Safety and Health Program Partnerships with the American Subcontractors' Association, the Painting and Decorating Contractors of America and the National Electrical Contractors of America to promote an automated (computerized) system to assist member contractors to develop site-specific safety and health programs for their sites, and provide recognition for contractors who use this automated system.		Ongoing	OSHA is reviewing the interactive video training programs that have been developed by these associations.	5
B2	DOL/OSHA		Implement a method for acquiring data specially designed to measure incidence of residential construction workplace illness and injury.		FY 2002	"Initial findings expected after three years of data collection. OSHA is working with Colorado St. University on developing this methodology.	

B2	DOL/OSHA		The NAHB Research Center training grant provides training and specialized materials to builders and contractors in 50 communities. Additional training through the National Safety Council/United Brotherhood of Carpenters training grant and the Scaffolding Training Partnership.		Sep-00	Additional trainings are underway. Over 24 eight-hour training seminars have been held throughout the US to date. Another 26 are under development for other cities.	5
B2	DOL/OSHA		Training through the National Safety Council/United Brotherhood of Carpenters training grant and the Scaffolding Training Partnership.			Additional trainings are underway.	5
B3	PATH/HUD		Begin evaluations of technology and construction process options that can improve disaster resistance.		Nov-00	PATH funded NAHBRC ISO framing project underway to demonstrate affordable, high quality, disaster resistant homes trough ISO certification. Results expected 11/00	2
B3	FEMA		Evaluate how PATH technologies may reduce incidence of property and casualty claims on home owners insurance, and whether such reduction may offer innovative insurance products for homeowners		Jun-99	Expansion of the FEMA program with Fannie Mae to 10-15 states.	8
B3	FEMA		Evaluate how PATH technologies may reduce incidence of property and casualty claims on home owners insurance, and whether such reduction may offer innovative insurance products for homeowners		Jun-00	Expand the program nationwide.	8
B3	FEMA		Evaluate how PATH technologies may reduce incidence of property and casualty claims on home owners insurance, and whether such reduction may offer innovative insurance products for homeowners.		Ongoing	FEMA is working with insurance industry groups to develop insurance incentives (discounts, deductible reductions/waivers, etc.) for properties using disaster-resistant technologies in the construction process.	8
B3	DOC/NIST	HUD	Study alternative affordable strategies and products for fire suppression in existing housing.		Sep-00	Phase one complete and protocol being developed	1
B3	DOC/NIST	HUD	Identify and characterize residential fire hazards and examine mitigation technologies. Develop test protocols.		May-00	Work initiated at NIST. Draft completed	1

B3	USDA/FS		Develop methods of evaluating structural performance, including the connections of wood-frame housing after natural disasters and develop low-cost methods of repair		On-going	Work in progress with $65K of USDA/FS funding.	11
B3	HUD		Develop improved disaster resistant installation technologies for manufactured housing.	Dec-99	Sep-00	Consumers guide to reducing dangers from natural disaster will be published in Fall 2000. Research on new technologies continues with industry.	4
B3	HUD		Deliver technical assistance through HUD on disaster relief in Latin American countries that were hit by Hurricanes Mitch and Georges.	Jun-99	Dec-00	Initial technical assistance has been provided to countries hit by Hurricane Mitch. Additional work dependent on Congressional funding. HUD received $12 million in AID funding. Technical assistance to countries is currently underway. HUD is providing seminars on disaster resistance.	5
B3	HUD		Deliver technical assistance through HUD on disaster relief in Latin American countries that were hit by Hurricanes Mitch and Georges.	May-99	Dec-00	Initial technical assistance has been provided to countries hit by Hurricane Mitch. Additional work dependent on Congressional funding. HUD received $12 million in AID funding. Technical assistance to countries is currently underway. HUD is providing seminars on disaster resistance.	5
B3	HUD		Conduct demonstrations in disaster prone communities of disaster mitigation approaches that meet PATH goals.		Sep-00	FEMA's Project Impact is working in local communities to showcase disaster mitigation strategies.	2
B3	FEMA		Document "success stories" associated with the use of mitigation technologies and practices (i.e., the reduction of damages).		On-going	FEMA has established "Building Performance Assessment Teams" to deploy to selected disaster areas.	11
B3	HUD		Develop new legislation or federal programs to reduce liability and risk.	Jun-99	Sep-99	PATH has established a Barriers/Insurance Issues working group to address this issue and has issued a "white paper" on product liability for review. Second draft being prepared. Complete PATH liability position paper by spring 2000. Disseminate & convene symposium to develop action agenda by fall 2000 including possible draft legislation.	1
B3	FEMA		Conduct pilot demonstrations of the incorporation of mitigation and energy efficiency technologies and practices through DOE's Weatherization Program.		Oct-99	HUD has transferred PATH funds to FEMA to initiate the pilots.	2

B3	HUD		Review FEMA materials for impact on affordability.	Jun-99	Jun-99	The Housing Affordability Through Design Efficiency program sponsored by HUD and industry partners has initiated this review.	1
B3	DOC/NIST	HUD/DOE	Develop a Building Innovation Center through NES that can perform evaluations on emerging technologies.		Jun-99	NIST is initiating program activities since funding from HUD made available in March 1999.	11
B3	FEMA		Conduct pilot demonstrations of FEMA's Tornado Saferoom technology in 10 homes.		Oct-99	HUD has transferred PATH funds to FEMA to initiate the pilots.	2
B3	FEMA		Conduct building performance evaluations in the aftermath of Presidentially declared disasters to determine the effectiveness of certain building technologies and practices used in that area.		On-going	FEMA has developed an Internet based collection database for mitigation success stories and is conducting benefit/cost analysis on some mitigation efforts.	7
B3	HUD		As part of rebuilding assistance in Central America, demonstrate at least 10 innovative technologies that can make homes more disaster resistant yet remain affordable to the Central American housing market.		Dec-00	Demonstration work dependent on Congressional funding. Funding not received.	2
B3	DOC/NIST		Develop test protocols for and demonstrates implementation of passive and active fire protection technologies, which could be economically implemented by residents, to increase the level of fire safety in the home.			There have been test protocols for implementing fire protection technologies. Test were conducted at bench-scale. They were very successful, however, the same efforts on a full-scale was not not. They are trying to resolve these difference. Furthermore, they have also identified additional funding sources through the US Fire Administration in order to support efforts on developing protocols for active fire suppression technologies. These efforts will continue into FY 2001.	1
B3	FEMA		Conduct building performance evaluations in the aftermath of Presidentially declared disasters to determine the effectiveness of certain building technologies and practices used in that area.		On-going	FEMA has established "Building Performance Assessment Teams" to deploy to selected disaster areas.	11
B3	FEMA		Perform and promote research and development on innovative building practices and materials designed to improve disaster resistance of structures.		Ongoing	PATH is still awaiting information from FEMA	4

B3	FEMA		Perform and promote testing and evaluation of residential envelope systems in simulated flood conditions that will verify their flood damage resistance and clearly define the details that will make the systems work efficiently.		Ongoing	PATH is still awaiting information from FEMA	4
B3	FEMA		Continue developing National, state, and local public-private partnerships designed to promote risk assessment and disaster resistance.		Ongoing	PATH is still awaiting information from FEMA	8
C	HUD		Working with industry, identify at least 2 new technologies that could cost-effectively and significantly reduce energy consumption in existing housing.	Jun-99	Jun-00	HUD has funded a cooperative research agreement with NAHB Research Center and Dow to develop new technologies for existing buildings. Reviewing applications by industry and academia for additional R&D on existing buildings.	4
C	HUD		Working with industry, identify at least 2 new technologies that could cost-effectively and significantly reduce energy consumption in existing housing.	Dec-99		HUD has funded a cooperative research agreement with NAHB Research Center and Dow to develop new technologies for existing buildings. Reviewing applications by industry and academia for additional R&D on existing buildings.	4
C	HUD		Conduct a statistical survey of the existing housing stock.	Apr-99	Sep-00	Study underway.	7
C	EPA	HUD/PATH	The ENERGY STAR Program will develop a marketing plan to promote energy efficiency in existing homes by September, 1999, identify metropolitan areas for pilot projects, and assess the best approach for achieving a 30 % reduction in energy efficiency in existing homes.		Sep-99	Weatherization program in operation. EPA marketing plan under development.	8

Attachment C: FY 1999 PATH Operating Plan Update

The report on activities identified in the 1999 PATH Operating Plan is organized based on the April 22, 1999 PATH Progress Report. It includes fields describing:

A. The **PATH Goal** addressed by each activity
B. The **Objective** is numbered as in the April 1999 operating plan for each activity
C. The **Planned Near Term Actions** scheduled to be undertaken
D. The **Milestone End Date** for each action (as identified in 1999)
E. The **Sponsoring Agencies** of each action
F. The **Status Report** on each action (as identified in 2000)
G. The **New Milestone End Date** for each action (as identified in 2000)

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PATH Goal	Objective	Planned Near Term Action	Milestone End Date (1999)	Sponsoring Agencies	Status Report (2000)	New Milestone End Date
1	1. Challenge PATH partners and all of the housing industry to invest in coordinated research development and demonstration activities that will help achieve PATH goals.	Provide leveraged cooperative research and development grants to industry based on a competitive program addressing high priority technology needs relating to the tough PATH performance and cost goals.	Jun-99	DOC/NIST	PATH Cooperative Research Program (PATH CoRP) is presently reviewing more than 50 proposals from industry led teams. Milestone slip to 4/00.	Apr-00
1	1. Challenge PATH partners and all of the housing industry to invest in coordinated research development and demonstration activities that will help achieve PATH goals.	Obtain R&D investment commitments from five industry partners by 9/30/99 totaling $2 million dedicated to the achievement of PATH goals.	Sep-99	HUD	Funded research is underway. MADE house development under development.	Completed
1	2. Put in place a process for recognizing significant advancements in technology, land use and construction practices that will help achieve PATH goals and promote their adoption by the building industry.	Recognize innovative home building and remodeling processes through awards programs.	On-going	DOE	National Housing Quality, National Remodeling Quality, and Energy Value Housing Awards given annually to innovative building firms.	Ongoing
1	2. Put in place a process for recognizing significant advancements in technology, land use and construction practices that will help achieve PATH goals and promote their adoption by the building industry.	Recognize innovative applications of new technologies through Secretarial awards.	Mar-99	HUD	Building Innovation in Housing Awards made and book published.	Completed
1	2. Put in place a process for recognizing significant advancements in technology, land use and construction practices that will help achieve PATH goals and promote their adoption by the building industry.	Conference on 21st Century Building Technologies scheduled for Orlando, FL in June.	Jun-99	HUD	Conference completed and proceedings published. PATH and NAHB Research Center staff presented at conference. PATH and FPL held National conference on housing durability.	Completed
1	2. Put in place a process for recognizing significant advancements in technology, land use and construction practices that will help achieve PATH goals and promote their adoption by the building industry.	Recognize innovative applications of new technologies through Secretarial awards.	Jan-00	HUD	Third annual Secretary's awards with Professional Builder magazine held. Other awards with American Planning Association, National Trust for Historic Preservation, and AIA.	Ongoing
1	2. Put in place a process for recognizing significant advancements in technology, land use and construction practices that will help achieve PATH goals and promote their adoption by the building industry.	Identify at least 200 emerging technologies that could help the building industry to accomplish the PATH goals.	Mar-99	PATH	PATH web site established (www.pathnet.org). PATH and Toolbase websites provide a technology inventory, demonstration, field evaluations database.	Completed

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1	2. Put in place a process for recognizing significant advancements in technology, land use and construction practices that will help achieve PATH goals and promote their adoption by the building industry.	Recognize innovative applications of new technologies through Secretarial awards.	On-going	PATH	Providing PATH awards to major new projects.	Ongoing
1	3. Track and evaluate emerging technologies and alternative materials for their potential to reduce housing costs (first and life cycle costs).	In cooperation with the model codes and the National Evaluation Service's Building Innovation Center (NES-BIC), develop evaluation plans for at least 10 emerging technologies and complete the comprehensive evaluation of at least one technology.	Dec-99	DOC/NIST	Supplemental Evaluation Fee Program announced with limited response from industry. Strategic alternatives being examined. Initial evaluation of one technology milestone slip to 12/00.	Dec-00
1	3. Track and evaluate emerging technologies and alternative materials for their potential to reduce housing costs (first and life cycle costs).	In conjunction with the NES-BIC, plan and develop a generic evaluation plan for same type technology.	Mar-00	DOC/NIST	Insulated Concrete Forms technology selected and process initiated. Milestone slip to 10/00.	Oct-00
1	3. Track and evaluate emerging technologies and alternative materials for their potential to reduce housing costs (first and life cycle costs).	Apply evaluation criteria to the 200 technologies that have been identified by the program to date and determine a subset of 25 technologies with near term potential to help the housing industry meet PATH goals.	Mar-99	HUD	Over 150 technologies listed on PATH and ToolBase Web sites. Each technology identified on quality of data and degree of development . Over 20 being tested in field evaluations and demonstrations. Developed categorization effort to rank technologies by state of market readiness.	Ongoing
1	4. Develop a model for identifying and testing new technologies that, if accepted into practice, would help achieve PATH goals.	Refine test method to measure the thermal conductivity of vacuum insulation panels.	Sep-99	DOC/NIST	Resources not yet available.	Not funded
1	4. Develop a model for identifying and testing new technologies that, if accepted into practice, would help achieve PATH goals.	Develop protocols for evaluating emerging technologies	Dec-99	DOC/NIST	Insulated Concrete Forms technology selected and process initiated.	Ongoing
1	5. Work with manufacturers to test the model for new technology prototypes.	Identify generic technology and 10 products for further evaluation.	Jun-99	DOC/NIST	Supplemental Evaluation Fee Program announced with limited response from industry. Strategic alternatives being examined.	Dec-00
1	6. Sponsor fundamental research through NSF at academic institutions that could lead to breakthrough technology applications relating to PATH goals.	Working together with the National Science Foundation (NSF), establish a residential buildings research program and award at least 25 grants to universities for basic research addressing PATH goals.	Sep-99	HUD/NSF	Review and selection process underway for 81 applications.	Apr-00

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1	7. Work with HUD program offices (Public Housing Indian Housing CPD) to identify suitable HUD-assisted projects that can be PATH demonstrations and pilots with near term technical assistance to incorporate PATH technologies in new and rehabilitated housing on the Pine Ridge Reservation in South Dakota various "Colonias" sites and disaster mitigation in Puerto Rico resulting from Hurricane Georges.	Select two CPD programs to initiate PATH demonstrations.	May-99	HUD	Discussions under way for demonstrations with local Youthbuild programs. Discussions also begun for working with CDBG and HOME programs.	Dec-00
1	7. Work with HUD program offices (Public Housing Indian Housing CPD) to identify suitable HUD-assisted projects that can be PATH demonstrations and pilots with near term technical assistance to incorporate PATH technologies in new and rehabilitated housing on the Pine Ridge Reservation in South Dakota various "Colonias" sites and disaster mitigation in Puerto Rico resulting from Hurricane Georges.	Select second Indian tribe for demonstrations.	Jun-99	HUD	Having discussions for a second site.	Dec-00
1	7. Work with HUD program offices (Public Housing Indian Housing CPD) to identify suitable HUD-assisted projects that can be PATH demonstrations and pilots with near term technical assistance to incorporate PATH technologies in new and rehabilitated housing on the Pine Ridge Reservation in South Dakota various "Colonias" sites and disaster mitigation in Puerto Rico resulting from Hurricane Georges.	Initiate PATH demonstrations with at least 2 Indian tribes. As part of this effort build at least 50 homes at Pine Ridge that use PATH technologies.	Aug-99	HUD	Pine Ridge, SD: The Oglala Sioux Tribal Partnership for Housing, Inc., as developer/builder, completed 20 houses that are now owned by tribal members. They are planning for construction of more houses in 2000.	Completed

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1	7. Work with HUD program offices (Public Housing Indian Housing CPD) to identify suitable HUD-assisted projects that can be PATH demonstrations and pilots with near term technical assistance to incorporate PATH technologies in new and rehabilitated housing on the Pine Ridge Reservation in South Dakota various "Colonias" sites and disaster mitigation in Puerto Rico resulting from Hurricane Georges.	Initiate PATH demonstrations with two HOPE VI sites.	Apr-99	HUD	HOPE VI Holyoke MA: Holyoke Housing Authority Churchill Homes Project chosen for demonstration. Construction documents to be completed around third week in March. HHA will advertise for construction bids.	Construction to start summer 2000
1	8. Conduct demonstrations of technologies that fit PATH goals relating to housing affordability.	Investigate options for manufacturing housing components and sub-systems which assemble easily on the job site, utilize low-cost, flexible manufacturing techniques, yet maintain high standards for precision and reliability.	Sep-99	HUD	Virginia Tech Phase I complete. Second phase under discussions.	To be determined
1	8. Conduct demonstrations of technologies that fit PATH goals relating to housing affordability.	Build a set of four Marketable Affordable Durable and Entry-Level (MADE) homes in a model subdivision and evaluate cost, performance and marketability of this concept.	Sep-99	HUD	Construction on MADE homes expected to begin by 6/30/00.	Jun-00
1	8. Conduct demonstrations of technologies that fit PATH goals relating to housing affordability.	Demonstrate the "Next Generation" Manufactured home in 3 developments with at least one manufacturer adding the "next generation home" to their product line.	Sep-99	HUD	"Next generation" house demonstrated in Danbury, Connecticut. Planning underway for development in Del Rio, Texas. Working with Champion Homes to build a Next Generation home at 2001 NAHB convention in Atlanta.	Completed
1	8. Conduct demonstrations of technologies that fit PATH goals relating to housing affordability.	Demonstrate Nationally Applicable Recommended Rehabilitation Provisions (NARRP) in at least 2 communities and have NARRP included in the International Residential Code published by the International Code Council (ICC).	Sep-99	HUD	Governor of Maryland introduced NAARP for state enactment.	Ongoing
1	8. Conduct demonstrations of technologies that fit PATH goals relating to housing affordability.	Develop a series of demonstration projects with builders on PATH technologies.	Sep-99	HUD	Twenty builders and nonprofit developers have committed to conduct demonstration projects incorporating technologies identified by the PATH program. Groundbreaking of three demonstrations in Dallas, TX, Tucson AZ, & La Plata, MD.	Ongoing
1	9. Coordinate activities with DOE's Building America program (see Goal 2).	Transfer lessons learned from Building America projects to PATH evaluation activities.	Apr-99	DOE	Began in FY 99, will continue through FY 2000.	Ongoing

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1	10. Provide technical assistance to identified PATH national pilot projects.	Initiate broad based technical assistance to at least five national pilot projects focusing on the PATH affordability goal.	Apr-99	HUD/DOE	HUD transferred funding to DOE to support the broadening of technical assistance for the national pilots. DOE through NREL is providing technical assistance to National pilots. PATH working to establish interagency assistance teams.	Ongoing
1	11. Work with program offices to modify forthcoming NOFAs (Notice of Fund Availability) including Super NOFAs to make use of appropriate PATH technologies as a factor for selection.	Participate in preparation of overall Super NOFA.	Sep-99	HUD	Participated in preparation of SuperNOFA.	Completed
1	11. Work with program offices to modify forthcoming NOFAs (Notice of Fund Availability) including Super NOFAs to make use of appropriate PATH technologies as a factor for selection.	Choose appropriate programs and prepare specific text for incorporation in Super NOFA	Nov-99	HUD	Text about PATH has been placed in the overview and for relevant programs in the $2.4 billion SuperNOFA (Notice of Funding Availability) scheduled for publication 2/24/00. The text calls attention to opportunities to make use of PATH technologies, citing the PATHnet.org web site and offering technical support in design and cost analysis of advanced technologies to be incorporated in project construction.	Completed
1	12. Work with HUD program offices to review regulations and guidance material to encourage use of new technologies.	Designate program office contacts to work on regulations and guidance material.	Apr-99	HUD	Memo sent to each Assistant Secretary on 6-22-99 to designate a contact to identify promising programs. PATH staff has begun working with the Office of Public and Indian Housing headquarters and field staff to identify HOPE VI and Capital Grant (modernization) projects to demonstrate use of PATH technologies. Also working with Offices of Block Grant Assistance (CDBG), Affordable Housing (HOME) and Office of Economic Development/Empowerment Center (Youthbuild).	Completed
1	12. Work with HUD program offices to review regulations and guidance material to encourage use of new technologies.	Review regulations and guidance material with each office to identify obstacles and prepare revisions.	Jun-99	HUD	Review of regulations began with construction cost limits, which are an obstacle.	Ongoing

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1	13. Develop a strategy and implement a targeted dissemination program to educate housing authorities, non-profits and other HUD grantees of the availability and proper application of appropriate PATH technologies.	Establish a new building technology dissemination program specifically targeted to HUD grantees, non-profits and housing authorities.	May-99	HUD	PATH demonstrations will be featured at Best Practices conference. Dissemination program under development by Aspen Systems.	Sep-00
1	13. Develop a strategy and implement a targeted dissemination program to educate housing authorities, non-profits and other HUD grantees of the availability and proper application of appropriate PATH technologies.	Develop publication on "Energy Resources for HUD Staff".	Jun-99	HUD	The publication "PATH Energy Desk Book for HUD Programs" is in final draft and will be ready for distribution following graphics enhancement.	Aug-00
1	13. Develop a strategy and implement a targeted dissemination program to educate housing authorities, non-profits and other HUD grantees of the availability and proper application of appropriate PATH technologies.	Create a centralized search tool for builders and remodelers that will make it easier for them to understand applicable federal, state and local programs applicable to housing.	Jun-99	HUD	Both PATHnet and ToolBase Websites are operational, well recognized, and widely used.	Completed
1	14. Identify codes and standards and legal and institutional issues that will either help to accelerate adoption or conversely are impediments. More specifically explore with the housing industry new or improved insurance and other programs that can reduce the fear of risk and resulting liability that may result from the use of innovative building products.	Fully establish, jointly with the three model code organizations, a National Evaluation Service Building Innovation Center and start the evaluation of at least 10 innovative technologies.	Dec-99	DOC/NIST	NES-BIC are established and operational. Supplemental Evaluation Fee Program announced with limited response from industry. Strategic alternatives being examined.	Completed
1	14. Identify codes and standards and legal and institutional issues that will either help to accelerate adoption or conversely are impediments. More specifically explore with the housing industry new or improved insurance and other programs that can reduce the fear of risk and resulting liability that may result from the use of innovative building products.	Document the experiences of communities that have undergone "regulatory streamlining" processes in conjunction with HUD and the National Conference of States on Building Codes and Standards (NCSBCS).	Apr-99	HUD	A National Conference on Regulatory Streamlining was held by NCSBCS in San Antonio.	Completed

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1	14. Identify codes and standards and legal and institutional issues that will either help to accelerate adoption or conversely are impediments. More specifically explore with the housing industry new or improved insurance and other programs that can reduce the fear of risk and resulting liability that may result from the use of innovative building products.	Document the experiences of communities that have undergone "regulatory streamlining" processes in conjunction with HUD and the National Conference of States on Building Codes and Standards (NCSBCS).	Sep-99	HUD	A National Conference on Regulatory Streamlining was held by NCSBCS in San Antonio.	Completed
1	14. Identify codes and standards and legal and institutional issues that will either help to accelerate adoption or conversely are impediments. More specifically explore with the housing industry new or improved insurance and other programs that can redu	In conjunction with the insurance industry, study practical options (including new test methods, product certifications, and demonstrations of innovative insurance rate structures) for reducing risk and, therefore, home insurance rates through the use of	Sep-99	HUD	PATH white paper on "Homeowners Insurance as a Tool for the Adoption of Innovation" released. Next steps under deliberation.	Ongoing
1	14. Identify codes and standards and legal and institutional issues that will either help to accelerate adoption or conversely are impediments. More specifically explore with the housing industry new or improved insurance and other programs that can redu	Develop new legislation or federal programs to reduce liability and risk.	Sep-99	HUD	The PATH Barriers/Insurance working group is preparing a second draft of the white paper on product liability.	Jun-00
1	15. Coordinate activities with EPA's ENERGY STAR Homes program (see Goal 2).	Develop a program and policy agreement between PATH and EPA Energy Star.	Apr-99	EPA/PATH	Ongoing	Ongoing
1	16. Conduct an aggressive program of informational outreach to communicate program results and direction to the housing industry and the general public.	Develop marketing tools for builders to promote PATH technology and homes.	Sep-99	EPA	On hold until PATH strategy is developed and the role of the consumer education task force is resolved.	Ongoing
1	16. Conduct an aggressive program of informational outreach to communicate program results and direction to the housing industry and the general public.	Establish ToolBase as the primary source of reliable technical information for the housing industry by providing a toll-free technical hotline to at least 8,000 builders and remodelers per year, a technical newsletter to at least 70,000 firms quarterly, a comprehensive Catalog of Building Products and Services published on CD-ROM and Internet that is distributed to at least 60,000 firms annually, and a technical web site with useful technical information on emerging home building technologies.	Mar-99	HUD	ToolBase is up and running. A technical hotline fields over 8,000 calls annually from builders and remodelers. Spanish language assistance was recently added. Outreach tools include a quarterly CD-ROM, a technical web site, and a quarterly technical newsletter distributed to 80,000 firms. Periodic forums are held with builders and manufacturers to discuss pressing issues in the industry.	Completed

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1	16. Conduct an aggressive program of informational outreach to communicate program results and direction to the housing industry and the general public.	The PATH program will develop and implement a communications plan which will focus on delivering information on program activities and results to the industry trade press and the general media. The program will coordinate the communications activities of	Apr-99	HUD/PATH	Six issues of PATHways newsletter published and distributed to over 25,000 recipients.	Ongoing
1	16. Conduct an aggressive program of informational outreach to communicate program results and direction to the housing industry and the general public.	Promote outreach through industry venues including conferences, periodicals, and existing home builder programs.	On-going	HUD/PATH	PATH is sponsoring the Second National Conference on Green Building and is exhibiting at the NAHB Show, the Remodelers Show, the Affordable Comfort conference, the Pennsylvania Housing Finance conference, and other building industry trade shows in FY2000.	Ongoing
1	16. Conduct an aggressive program of informational outreach to communicate program results and direction to the housing industry and the general public.	The USDA Cooperative State Research, Education and Extension Service (CSREES) will conduct outreach activities in "green" construction, environmental landscape management, and the energy and environmental advantages of using new technologies.	Sep-99	USDA/ CSREES	Sustainable Housing conference conducted October 18-19, 1999 in Orlando, FL. Attended by approximately 50 people from 10-12 states.	Completed
1	17. Conduct laboratory and short-term field testing and communicate the results and recommendations for product improvements back to manufacturers.	Conduct laboratory testing on affordable, durable technologies.	On-going	DOC/NIST	Along with the service life prediction work in the predecessor paint and coatings program, new initiatives have been started regarding sealants and roofing.	Ongoing
1	17. Conduct laboratory and short-term field testing and communicate the results and recommendations for product improvements back to manufacturers.	Conduct cooperative R&D with industry partners.	On-going	HUD	Cooperative R&D projects with DOW and Wood Truss Council of America underway and to continue in FY00. Conducting research with NAHB in improving engineering performance and affordability of wood structures. Research with Manufactured Housing Research Alliance on steel applications and installation techniques now fully underway.	Ongoing
1	17. Conduct laboratory and short-term field testing and communicate the results and recommendations for product improvements back to manufacturers.	Conduct field testing on specific technologies.	On-going	HUD	Field testing of technologies meeting PATH evaluation criteria underway with twelve builders.	Ongoing

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1	17. Conduct laboratory and short-term field testing and communicate the results and recommendations for product improvements back to manufacturers.	Develop shear design criteria to support allowable stress design and reliability-based design building codes.	Oct-00	USDA/FS	Work in progress with $20K of USDA/FS funding.	Oct-00
1	17. Conduct laboratory and short-term field testing and communicate the results and recommendations for product improvements back to manufacturers.	Develop test methods and evaluation procedures for wood-based building materials for more efficient code approval and acceptance.	Oct-00	USDA/FS	$500K IAA with Forest Products Laboratory for research on wind resistance and durability of wood products.	Oct-00
1	17. Conduct laboratory and short-term field testing and communicate the results and recommendations for product improvements back to manufacturers.	Develop test methods and evaluation procedures for wood-based building materials for more efficient code approval and acceptance.	On-going	USDA/FS	Work in progress with $15K of USDA/FS funding.	Ongoing
1	18. Deliver technical assistance to companies in making necessary improvements to their products so that they can gain code and market acceptance with their innovative products and systems.	Provide technical assistance to firms who are developing products relating to the PATH goals.	Sep-99	HUD	Working with Dow chemical to improve vuuum insulation technology	Ongoing
1	19. Conduct evaluations and document the costs and performance attributes of PATH technologies that have been incorporated into recently completed demonstration projects.	Building America to develop documentation on cost and performance.	Jun-99	DOE	No data yet made available to PATH from DOE	
1	19. Conduct evaluations and document the costs and performance attributes of PATH technologies that have been incorporated into recently completed demonstration projects.	Develop procedure for evaluating the performance of PATH demonstrations and field tests.	Apr-99	HUD	Procedure for documenting performance evaluations created and is being used by the NAHB Research Center in gathering data on field performance.	Completed
2	1. Develop an environmental baseline that will enable the measurement of progress toward achieving PATH environmental goals.	EPA's ENERGY STAR Home's builder recruitment program will incorporate the PATH initiative in all builder presentations by July, 1999.	Jun-99	EPA/PATH	Development of baseline underway. Anticipated completion 6/01	Jun-01
2	2. Develop approaches for incorporating energy efficiency improvements into the remodeling of existing residences.	Improve the energy efficiency of 67,000 low income homes in FY 99.	Dec-99	DOE	Weatherized 67,330 homes, saving $1.80 for every dollar invested over the life of the measures.	Completed

2	2. Develop approaches for incorporating energy efficiency improvements into the remodeling of existing residences.	The ENERGY STAR Program will develop a marketing plan to promote energy efficiency in existing homes by September, 1999, identify metropolitan areas for pilot projects, and assess the best approach for achieving a major reduction in energy efficiency in existing homes.	Sep-99	EPA	EPA recently completed a national model to demonstrate how Energy Star can achieve a major reduction in energy use in existing homes.	Jun-00
2	2. Develop approaches for incorporating energy efficiency improvements into the remodeling of existing residences.	Working with industry, identify at least 2 new technologies that could cost-effectively and significantly reduce energy consumption in existing housing.	Dec-99	HUD	Technology Roadmapping strategy developed for new and existing buildings. Initial meeting of roadmapping group held 3/8-9/00.	Ongoing
2	2. Develop approaches for incorporating energy efficiency improvements into the remodeling of existing residences.	Working with industry, identify at least 2 new technologies that could cost-effectively and significantly reduce energy consumption in existing housing.	Jun-00	HUD	Reviewing applications by industry and academia for additional R&D on existing buildings.	Jun-00
2	3. Evaluate emerging technologies for their potential to reduce home energy use without raising costs or negatively impacting durability or indoor air quality.	Develop and disseminate computer software which enables simplified compliance with building codes.	Apr-99	DOE	Developed and disseminated software tools and materials for implementing new Federal residential and commercial energy codes.	Completed
2	3. Evaluate emerging technologies for their potential to reduce home energy use without raising costs or negatively impacting durability or indoor air quality.	Develop improved computer tool to help building designers include energy efficiency options in multi-family buildings.	Sep-99	DOE	Completed and released the final version of DOE-2.2, which is easier to use and simulates building envelope and HVAC technologies.	Completed
2	3. Evaluate emerging technologies for their potential to reduce home energy use without raising costs or negatively impacting durability or indoor air quality.	Verify the performance of alternative home ventilation strategies.	Sep-99	EPA	2-year study launched in Fall 1999 to test 3 different ventilation systems in 3 different climates.	Ongoing
2	3. Evaluate emerging technologies for their potential to reduce home energy use without raising costs or negatively impacting durability or indoor air quality.	Verify the performance of alternative home ventilation strategies.	Dec-99	HUD/DOC/NIST	Research program to validate predictive methods intended for use in Indoor Environment evaluations within the framework of residential performance standards and to provide a method to demonstrate the performance of and facilitate development of innovative residential IAQ control technologies. (9/00) Technical report on pilot phase for VOC and humidity control equipment.	Sep-00

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2	3. Evaluate emerging technologies for their potential to reduce home energy use without raising costs or negatively impacting durability or indoor air quality.	Assess performance of housing insulation systems for energy efficiency, moisture movement and durability.	On-going	USDA/FS	Research is underway and ongoing.	Ongoing
2	3. Evaluate emerging technologies for their potential to reduce home energy use without raising costs or negatively impacting durability or indoor air quality.	Continue evaluation of VOC emissions from particleboard and MDF.	Fall, 2000	USDA/FS	Research is actively underway and on schedule for milestone end date.	Fall, 2000
2	4. Deliver technical assistance to companies in making necessary improvements to their products so that they can gain code and market acceptance with their innovative products and systems.	Prepare a "white paper" on the role of home automation systems to address PATH goals relating to energy and environmental efficiency, cost, maintenance and repair.	Sep-99	OSTP	RAND Corp. convened conference and "white paper" complete and available.	
2	4. Deliver technical assistance to companies in making necessary improvements to their products so that they can gain code and market acceptance with their innovative products and systems.	Continue to develop and demonstrate new technologies such as residential fuel cells and advanced windows that have residential housing applications.	On-going	HUD/DOE	sites under negotiation	
2	5. Deliver technical assistance to builders and home systems providers on energy efficient construction practices that also do not diminish indoor air quality.	Expand Building America to include over 100 industry members, indirectly transferring innovations to 150,000 production homes.	Sep-00	DOE	Achieved 100 members and began construction of 5 additional community scale projects.	Completed
2	5. Deliver technical assistance to builders and home systems providers on energy efficient construction practices that also do not diminish indoor air quality.	Develop and implement training programs for builders for delivery in twenty communities in FY99 enabling them to take maximum advantage of new energy efficient technologies.	Jun-99	DOE	Sponsored more than two dozen residential build/design training programs.	Completed
2	5. Deliver technical assistance to builders and home systems providers on energy efficient construction practices that also do not diminish indoor air quality.	EPA's ENERGY STAR Homes Program, in conjunction with other offices within EPA, will establish an environmental baseline by July, 2000.	Jun-00	EPA	Baseline work is dependent on PATH strategy to develop the environmental baseline.	Ongoing
2	5. Deliver technical assistance to builders and home systems providers on energy efficient construction practices that also do not diminish indoor air quality.	Work on the Green Builder Model Program and the National Green Builder Conference scheduled for April 1999.	Dec-99	EPA/DOE	First Conference was a success. Second Conference is scheduled for April 2000. "Developing Green Builder Programs" is available at the Smart Growth website.	Completed
2	5. Deliver technical assistance to builders and home systems providers on energy efficient construction practices that also do not diminish indoor air quality.	Assist ten communities to institutionalize green building and energy efficient building technologies.	Sep-99	EPA/DOE/PATH	Looking for suitable demonstration sites	Sep-00

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2	5. Deliver technical assistance to builders and home systems providers on energy efficient construction practices that also do not diminish indoor air quality.	The ENERGY STAR Homes Program will have 15,000 ENERGY STAR Homes constructed during 1999.	Dec-99	EPA/PATH	Currently 10,000 homes are in the database. It will take an additional 3 months before Energy Star closes out the year due to late filers.	Mar-00
2	5. Deliver technical assistance to builders and home systems providers on energy efficient construction practices that also do not diminish indoor air quality.	Develop the preliminary plan for a Healthy Homes Initiative and submit to Congress.	Apr-99	HUD/EPA	$4.5 million in grants was made available in July 1999. 52 proposals were received and 5 grants were awarded, most of which focus on asthma and lead hazards.	Completed
2	6. Coordinate activities with the EPA ENERGY STAR Homes program and DOE's Building America program.	Provide technical documentation of Building America program results to include in the EPA ENERGY STAR Homes program.	Jun-99	DOE	No data yet available to PATH from DOE	
2	7. Provide technical assistance to identified PATH pilot projects.	Expand federal participation in the PATH pilot projects to include all participating federal agencies.	Apr-99	DOE (lead)	Meeting held April 6, 1999 between five National Pilot project teams and nine participating federal agencies to broaden pilot projects to address all PATH goals.	Completed
2	7. Provide technical assistance to identified PATH pilot projects.	Expand federal participation in the PATH pilot projects to include all participating federal agencies.	Apr-99	DOE/HUD	HUD is issuing an Inter Agency Agreement with DOE to expand the federal role in each of the five National Pilot projects.	Completed
2	8. Conduct evaluations and document the costs and performance attributes of technologies that have been incorporated into recently completed housing projects with federal sponsorship.	Conduct an evaluation and document the cost and performance results of the projects funded under the Building America program.	Sep-99	DOE	Awaiting documentation on Cost to be made available to PATH from DOE	
2	8. Conduct evaluations and document the costs and performance attributes of technologies that have been incorporated into recently completed housing projects with federal sponsorship.	Develop an OMB-approved study design by July 1999 for evaluating the cost and performance attributes of a statistical sampling of homes built under the Energy Star homes program and begin the evaluation process by September 1999.	Jul-99	EPA	Plan received OMB approval. OMB must now publish the ICR. Evaluation may begin in late Summer 2000.	Aug-00
2	9. Evaluate and delineate the appropriate role of deconstruction as an approach to reducing waste and recycling building materials.	Evaluate differing approaches toward building deconstruction for optimal materials conservation.	Sep-99	EPA/PATH	Study based on analysis of opportunities for deconstruction in Washington, DC is available at the Smart Growth web site.	Completed
2	9. Evaluate and delineate the appropriate role of deconstruction as an approach to reducing waste and recycling building materials.	Evaluate differing approaches toward building deconstruction for optimal materials conservation.	Sep-00	HUD	Work underway. HUD/PATH supporting GreenBuilder Conference. Green Building strategy development is underway.	Sep-00
2	9. Evaluate and delineate the appropriate role of deconstruction as an approach to reducing waste and recycling building materials.	Evaluate differing approaches toward building deconstruction for optimal materials conservation.	Sep-00	HUD/USDA	HUD has issued an IAA to the Forest Products Laboratory to create a rating system for deconstructed lumber.	Sep-00

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3	1. Determine high priority areas of need in residential construction relating to durability.	Develop draft housing durability research agenda and initiate research activities.	Sep-99	DOC/NIST	Completed.	Completed
3	1. Determine high priority areas of need in residential construction relating to durability.	Develop draft housing durability/service life prediction protocol for use by NES-BIC and others.	Mar-00	DOC/NIST	NIST contract with NES-BIC is underway. On schedule for 3/00.	Mar-00
3	1. Determine high priority areas of need in residential construction relating to durability.	Analyze problems and issues that have been raised by builders and remodelers placing calls to the ToolBase Hotline.	Jun-99	HUD/DOC/NIST	No contact on any such issues.	No contact
3	2. Identify the magnitude and occurrence rates of various performance problems in existing housing.	Conduct a statistical survey of the existing housing stock.	Sep-00	HUD	HUD study on an initial pilot survey completed. Study is underway.	Sep-00
3	3. Evaluate alternative materials that can improve the durability of building systems while reducing homeowner maintenance requirements.	Conduct a research needs assessment for alternative materials use in housing.	Jul-99	HUD	HUD has a cooperative agreement with the NAHB Research Center to conduct work in this area.	Ongoing
3	3. Evaluate alternative materials that can improve the durability of building systems while reducing homeowner maintenance requirements.	Begin work on a research needs assessment for wood product use in housing -- conducted in cooperation with university and industry researchers.	Dec-99	USDA/FPL	Advanced Housing Research Center funded for $1 million in President's FY 2001 budget. AHRC will rely on partnerships and alliances with universities, industry, interest groups, other branches of the Forest Service, and Federal, state, and local agencies.	Ongoing
3	4. Evaluate emerging technologies for their potential to prolong the life of residential structures.	Develop process for evaluating performance of a limited number of applications of new technologies prior to their widespread adoption.	Jun-99	HUD	Performance evaluation plans are being developed for technologies being used in the NAHB Research Center demonstration projects.	Sep-00
3	5. Conduct evaluations and document the costs and performance attributes of PATH technologies that have been incorporated into recently completed DOE demonstration projects.	Building America to develop documentation on cost and performance.	May-99	DOE	No data yet available to PATH from DOE	
3	5. Conduct evaluations and document the costs and performance attributes of PATH technologies that have been incorporated into recently completed demonstration projects.	Develop procedure for evaluating the performance of PATH demonstrations and field tests.	May-99	HUD	Procedure for documenting performance evaluations created and is being used by the Research Center in gathering data on field performance.	Completed
3	6. Conduct research to improve performance of exterior building products.	Initiate research to reduce the time to measure the photo-degradation of paints.	On-going	DOC/NIST	Principally supported by the automotive industry but fits in part with the overall PATH-D (National Durability Research) Program.	Ongoing

3	6. Conduct research to improve performance of exterior building products.	Conduct research on durability of building material adhesives, material properties of composites under cyclic temperature and humidity conditions, durability of water-borne, water-repellent preservatives and other low VOC water-repellent finishes.	Sep-00	USDA/FS	Research is actively underway and on schedule for milestone end date.	Sep-00
3	6. Conduct research to improve performance of exterior building products.	Conduct research on durability of building material adhesives, material properties of composites under cyclic temperature and humidity conditions, durability of water-borne, water-repellent preservatives and other low VOC water-repellent finishes.	On-going	USDA/FS	Research is underway and ongoing.	Ongoing
3	6. Conduct research to improve performance of exterior building products.	Evaluate mechanical properties of treated lumber under conditions of high temperature and humidity.	Oct-00	USDA/FS	Research is actively underway and on schedule for milestone end date.	Oct-00
3	6. Conduct research to improve performance of exterior building products.	Evaluate the durability of reinforced glulam beams.	Oct-00	USDA/FS	Research is actively underway and on schedule for milestone end date.	Oct-00
3	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products and construction practices that contribute toward enhanced durability and reduced maintenance and repair.	Develop a Building Innovation Center through NES that can perform evaluations on emerging technologies.	Jun-99	DOC/NIST	NES-BIC is operational.	Completed
3	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products and construction practices that contribute toward enhanced durability and reduced maintenance and repair.	Refine draft guides on structural safety and serviceability, functionality, durability, indoor atmosphere, acoustics and economics as components of performance standards for housing.	Sep-99	DOC/NIST	Durability, Functionality, Indoor Air Quality standard guides out for ASTM E6.66 subcommittee ballot. Economics and Structural Safety and Serviceability in draft form. Acoustics not being done at this time.	Ongoing
3	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products and construction practices that contribute toward enhanced durability and reduced maintenance and repair.	Begin evaluations of technology and construction process options that can improve construction durability.	Jul-99	HUD	Over 150 technologies have been included in the PATH technology inventory. Promising technologies were evaluated in the field by builders during Summer 1999.	Ongoing

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3	8. Based on the results of previous evaluations identify a set of high-priority technologies that if accepted into practice would help achieve PATH durability goals.	Durability research data to be produced in Computer Integrated Knowledge Systems.	Oct-00	DOC/NIST	Part of PATH-D program. Framework to be initiated 3/00. First generation of framework to be reported 11/00.	Nov-00
3	8. Based on the results of previous evaluations identify a set of high-priority technologies that if accepted into practice would help achieve PATH durability goals.	Distribute technical information to university based housing research centers.	On-going	HUD	NAHB Research Center is working closely with the 18 member Consortium of University-Based Housing Research Centers to disseminate research findings among consortium members and the building industry.	Ongoing
3	8. Based on the results of previous evaluations identify a set of high-priority technologies that if accepted into practice would help achieve PATH durability goals.	With other PATH partners, university and industry researchers, USDA Forest Service will continue distribution of research findings and conduct a conference/workshop on durability issues in housing.	Fall, 1999	USDA/FS	Conference and workshops on "Durability and Disaster Mitigation in Wood Frame Housing" held in Madison, WI on November 1-3, 1999. Next conference scheduled for November 6-8, 2000.	Completed
3	9. Develop wide ranging product and systems demonstrations throughout the U.S. incorporating high-priority PATH technologies and evaluate methods for streamlining acceptance of advanced technologies and communicate the results to the industry and the general public.	Develop and build both site-built and manufactured homes that meet multiple PATH goals.	Sep-99	HUD	"Next generation" house demonstrated in Danbury, Connecticut.	Completed
3	9. Develop wide ranging product and systems demonstrations throughout the U.S. incorporating high-priority PATH technologies and evaluate methods for streamlining acceptance of advanced technologies and communicate the results to the industry and the general public.	Develop and build both site-built and manufactured homes that meet multiple PATH goals.	Sep-00	HUD	MADE house development under development.	Sep-00
4	1. Develop an approach for systematically improving the quality of housing that is better able to resist the forces of natural hazards.	Evaluate how PATH technologies may reduce incidence of property and casualty claims on home owners insurance, and whether such reduction may offer innovative insurance products for homeowners.	Jun-99	FEMA	Incorporate initiative into a new National Pilot Community.	Ongoing
4	1. Develop an approach for systematically improving the quality of housing that is better able to resist the forces of natural hazards.	Evaluate how PATH technologies may reduce incidence of property and casualty claims on home owners insurance, and whether such reduction may offer innovative insurance products for homeowners.	Jun-00	FEMA	Incorporate initiative into a new National Pilot Community.	Ongoing

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4	1. Develop an approach for systematically improving the quality of housing that is better able to resist the forces of natural hazards.	Evaluate how PATH technologies may reduce incidence of property and casualty claims on home owners insurance, and whether such reduction may offer innovative insurance products for homeowners.	On-going	FEMA	Incorporate initiative into a new National Pilot Community.	Ongoing
4	2. Evaluate alternative materials that can improve the ability of building systems to resist fire and natural disasters.	Study alternative affordable strategies and products for fire suppression in existing housing.	Sep-00	DOC/NIST	Initial limited work funded and findings to be included in 8/00 report.	Aug-00
4	3. Evaluate emerging technologies for their potential to meet PATH goals of housing affordability and disaster mitigation.	Review FEMA materials for impact on affordability.	Jun-99	HUD	No action yet taken	
4	3. Evaluate emerging technologies for their potential to meet PATH goals of housing affordability and disaster mitigation.	Develop methods of evaluating structural performance, including the connections of wood-frame housing after natural disasters and develop low-cost methods of repair.	On-going	USDA/FS	Research is underway and ongoing.	Ongoing
4	4. Deliver technical assistance through HUD on disaster relief in Latin American countries that were hit by Hurricanes Mitch and Georges.	Deliver technical assistance through HUD on disaster relief in Latin American countries that were hit by Hurricanes Mitch and Georges.	Jun-99	HUD	HUD received $12 million in AID funding. Technical assistance to countries currently underway .	Dec-00
4	5. Demonstrate disaster mitigation approaches in the rehabilitation of damaged housing and the construction of new housing in the communities damaged by Hurricanes Mitch and Georges.	As part of rebuilding assistance in Central America, demonstrate at least 10 innovative technologies that can make homes more disaster resistant yet remain affordable to the Central American housing market.	On-going	HUD	Funding was not received.	Not funded
4	6. Conduct evaluations and document the costs and performance attributes of PATH technologies that have been incorporated into recently completed demonstration projects.	Conduct pilot demonstrations of the incorporation of mitigation and energy efficiency technologies and practices through DOE's Weatherization Program.	On-going	FEMA	Development of mitigation training for Weatherization inspectors is underway. Pilot training expected to commence late April, 2000. Actual mitigation measures in WAP homes will be funded by PATH grant.	Ongoing
4	6. Conduct evaluations and document the costs and performance attributes of PATH technologies that have been incorporated into recently completed demonstration projects.	Conduct pilot demonstrations of FEMA's Tornado Saferoom technology in 10 homes.	Oct-99	FEMA	FEMA/PATH initiative to construct saferooms in four at-risk communities (Tulsa, OK; Sioux City ,IA; North Sioux City, SD; and South Sioux City, NB) is underway The Comprehensive Tulsa/Home Builders Association Pilot alone will construct saferooms in eight	Ongoing

4	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products designs and construction practices that contribute toward enhanced resistance to fire and natural disasters.	Identify and characterize residential fire hazards and examine mitigation technologies. Develop test protocols.	May-00	DOC/NIST	Program on schedule. Final report 8/00.	Aug-00
4	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products designs and construction practices that contribute toward enhanced resistance to fire and natural disasters.	Document "success stories" associated with the use of mitigation technologies and practices (i.e., the reduction of damages).	On-going	FEMA	Includes documentation of benefits associated with the use of mitigation technologies.	Ongoing
4	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products designs and construction practices that contribute toward enhanced resistance to fire and natural disasters.	Conduct building performance evaluations in the aftermath of Presidentially declared disasters to determine the effectiveness of certain building technologies and practices used in that area.	On-going	FEMA	Building Performance Assessment Teams (BPAT's) activated to Presidentially declared disaster areas as needed.	Ongoing
4	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products designs and construction practices that contribute toward enhanced resistance to fire and natural disasters.	Begin evaluations of technology and construction process options that can improve disaster resistance.	Jul-99	HUD	Building Performance Assessment Teams (BPAT's) activated to Presidentially declared disaster areas as needed.	Ongoing
4	7. Conduct extensive field testing and evaluations with builders remodelers and product manufacturers on the installation and field performance of innovative products designs and construction practices that contribute toward enhanced resistance to fire and natural disasters.	Develop improved disaster resistant installation technologies for manufactured housing.	Dec-99	HUD	Research underway through a cooperative agreement with the Manufactured Housing Research Alliance to investigate technical solutions for new manufactured housing. HUD/PATH published Guidebook on installations.	Jun-00

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4	8. Based on the results of previous evaluations identify a set of high-priority technologies that if accepted into practice would help achieve PATH disaster mitigation goals.	Conduct building performance evaluations in the aftermath of Presidentially declared disasters to determine the effectiveness of certain building technologies and practices used in that area.	On-going	FEMA	Building Performance Assessment Teams (BPAT's) activated to Presidentially declared disaster areas as needed.	Ongoing
4	9. Develop wide ranging product and systems demonstrations throughout the U.S. incorporating high-priority PATH technologies and evaluate methods for stream-lining acceptance of advanced technologies and communicate the results to the industry and the general public.	Conduct demonstrations in disaster prone communities of disaster mitigation approaches that meet PATH goals.	Sep-00	HUD	Building Performance Assessment Teams (BPAT's) activated to Presidentially declared disaster areas as needed.	Jun-00
4	10. Develop partnerships and other cooperative efforts with the PATH partners to identify and address significant workplace hazards emphasizing those targeted by OSHA's performance goals.	Continue implementing the HomeSafe Partnership with the Home Builders Association of Metropolitan Denver. The Partnership has a ten point program based on actual accident experience to address specific hazards causing fatal and serious accidents and a design solution for managing the risks inherent in the residential home building industry (OSHA).	On-going	DOL/OSHA	Additional partnerships are being considered.	Ongoing
4	11. Deliver an appropriate mix of interventions and compliance assistance tools to assist home builders in complying with OSHA safety regulations.	Provide expert assistance to small and medium employers, including residential contractors and other employers with no more than 250 employees (OSHA).	Sep-99	DOL/OSHA	An additional 2,000 consultation visits were conducted in FY 1999.	Ongoing
4	11. Deliver an appropriate mix of interventions and compliance assistance tools to assist home builders in complying with OSHA safety regulations.	Develop a focused inspections guidance document for the construction industry (OSHA).	On-going	DOL/OSHA	Document has been developed.	Completed

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4	12. Develop a standardized valid safety and health program evaluation measurement tool which can be used to assess the quality of a safety and health program. Use the results from application of the tool to assist home builders in implementing or improving their safety and health programs.	Develop Safety and Health Program Partnerships with the American Subcontractors' Association, the Painting and Decorating Contractors of America and the National Electrical Contractors of America to promote an automated (computerized) system to assist member contractors to develop site-specific safety and health programs for their sites, and provide recognition for contractors who use this automated system.	On-going	DOL/OSHA	The Associated Builders and Contractors Association was added to the list of partnerships.	Ongoing
4	12. Develop a standardized valid safety and health program evaluation measurement tool which can be used to assess the quality of a safety and health program. Use the results from application of the tool to assist home builders in implementing or improving their safety and health programs.	Implement a method for acquiring data specially designed to measure incidence of residential construction workplace illness and injury.	On-going	DOL/OSHA	Data collection is underway by Colorado State University.	Completed
4	13. Make safety and health information and materials easily accessible to home builders and workers via both the Internet and paper based publications.	OSHA will continue developing and delivering safety and health information through its web site, the OSHA CD-ROM, Compliance Advisors Software, and the Job Safety and Health Quarterly.	On-going	DOL/OSHA	OHSA is continually updating and revising information.	Ongoing
4	14. Develop and disseminate occupational safety and health training and reference materials which address the needs of small home builders and workers.	The train-the-trainer construction outreach program organizations include construction trade unions, construction associations, and insurance companies.	Aug-99	DOL/OSHA	Train the trainer sessions were held in Summer 1999.	Sep-00
4	14. Develop and disseminate occupational safety and health training and reference materials which address the needs of small home builders and workers.	Disseminate the Jobsite Safety Handbook for small contractors, jointly produced by OSHA and NAHB, the Construction Regulations for the Home Building Industry manual, pocket cards on OSHA requirements for use in the field by supervisors and workers, and Fatal Facts and hazard information bulletins to alert home builders to hazards.	Apr-99	DOL/OSHA	Approximately 10,000 publications were distributed in FY 1999.	Completed
4	14. Develop and disseminate occupational safety and health training and reference materials which address the needs of small home builders and workers.	Training through the National Safety Council/United Brotherhood of Carpenters training grant and the Scaffolding Training Partnership.	Mar-99	DOL/OSHA	Approximately 50 trainings were completed in FY 1999.	Sep-00

4	14. Develop and disseminate occupational safety and health training and reference materials which address the needs of small home builders and workers.	The NAHB Research Center training grant provides training and specialized materials to builders and contractors in 50 communities.	Mar-99	DOL/OSHA	Approximately 100 trainings were held throughout the United States in FY 1999.	Sep-00

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