

PATH TECHNOLOGY ROADMAPPING

Prepared for:

PATH Industry Steering Committee

Prepared by:

NAHB Research Center, Inc.
400 Prince George's Boulevard
Upper Marlboro, MD 20774-8731

January 6, 2000

1. THE PARTNERSHIP FOR ADVANCING TECHNOLOGY IN HOUSING

The Partnership for Advancing Technology in Housing ("PATH") is a public-private partnership that was created to improve new and existing American homes in several important ways.



PATH has a very ambitious series of goals that were set forth when the program was created. The specific goals, to be achieved by the year 2010, are to put technologies into the marketplace that 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 decrease by at least 20 percent residential construction work illnesses and injuries.

There are multiple approaches for pursuing and achieving the PATH goals. Some involve institutional change. Others revolve around education and training. Still others rely on expanding the use of products, systems and technologies that are already commercially available. All of these approaches are being pursued in one way or another. At the same time, achieving major progress in PATH will require R&D leading to the demonstration, deployment and diffusion of new technologies, as well as work to enhance other technologies that have yet to achieve market success. An aggressive but thoughtfully structured approach to R&D of many different types, together with systematic follow-up, will greatly enhance the impact of PATH.

"Technology roadmapping" is a process of defining and organizing potential R&D activities to facilitate decisions about resource allocation and achieve specified ends. This kind of process has been and continues to be applied in many different organizations, industries and technological contexts. The types of technologies included can range from tangible new materials, products and systems to improved methods of production, software and other information technologies.

There is a recognized need to develop and tailor a technology roadmapping process for ongoing use under PATH as well. This document sets forth an approach to roadmapping that can meet that need. The approach is patterned after roadmapping methodologies used in other industries, but the unique context of PATH has also been taken into account. PATH is unique because it must address a broad and challenging set of goals, working with a highly fragmented home building industry that lacks centralized authority; a multitude of suppliers of products, materials and services; and a set of government agencies with widely differing missions and values. In order for the PATH roadmapping process to succeed, both as it begins and as it evolves into the future, it must be open, inclusive, and responsive to the needs of many end users.

2. OBJECTIVE AND SCOPE OF PATH TECHNOLOGY ROADMAPPING

The objective of technology roadmapping performed under PATH is to identify technologies that can, in combination, meet the PATH goals, and to define specific research and development activities required to implement these technologies. In this respect, the PATH goals are collectively taken to constitute the "vision" of housing as of 2010 that forms the basis for the PATH technology roadmapping work.

Understanding and interpreting the PATH goals is an essential part of the process. The PATH goals apply to both new and existing housing, but treat the two in different ways. Most of the goals relate clearly to new homes. The one goal that uniquely applies to existing housing calls for at least a 30 percent reduction in energy use in at least 15 million existing homes. In addition, the goal that calls for improving durability and reducing maintenance cost by 50 percent is clearly relevant to existing homes to the extent that they include major products and systems that will require replacement in the future and present opportunities for incorporating alternatives more durable than the items they are replacing. These goals and their application to existing homes need to be addressed as part of the overall roadmapping process.

The scope of the roadmaps to be developed under this effort includes combinations of short, intermediate and long-range technology development in areas that will contribute significantly to achieving the PATH goals. Each program of research and development activities will be presented as a series of steps extending over a period of time, potentially reaching out as far as the year 2010. Depending on the nature and outputs of the necessary R&D, specific activities will be classified into four alternative categories, according to how they will be most efficiently performed and who will own rights to the results:

- private sector, proprietary research (e.g., funded and performed by a single manufacturer)
- private sector, collaborative research, (e.g., funded by a group of manufacturers)
- government/industry partnerships, where each sector provides part of the funding, or
- government funded research, where the results belong to the public domain.

Roadmaps will focus on research and development, but in most cases should extend beyond successful product development to include demonstration and possibly even deployment or initial commercialization. The process does not really end until new products are brought to market and available for use. The ultimate extent of their utilization is, of course, to be determined by the market.

Certain roadmapping projects that have been partially or completely performed may be useful for PATH. For instance, a window industry roadmapping process initiated in 1998 has led to at least two published reports. It is expected that PATH technology roadmapping will draw upon or perhaps even incorporate the results of other similar but more narrowly focused work, where it is consistent with the vision and approach of the PATH program.

The technology roadmaps developed through this process will be used in several ways. First, they will provide an extensive and growing body of information about what is necessary to successfully develop many beneficial new technologies, documenting both what is being done and what remains to be done. Second, they will offer expert opinions about the likely costs,

PATH TECHNOLOGY ROADMAPPING

risks, benefits and time required in connection with any given program of technology development. Public sector organizations can and should use this to analyze and assign priorities among alternative R&D investments relating to PATH. PATH itself can use the information to determine critical gaps in research that would serve program goals. And private sector firms can consider this information in developing their own plans for product development or establishing research consortia, assuming they choose to align their activities with industry-wide work under PATH. At a minimum the roadmaps will simplify the coordination of R&D activities being carried out by multiple organizations in a diverse and fragmented sector of the economy. In this way they will help minimize redundancy, channel private research into areas likely to yield public benefits, and expose opportunities for synergies that could otherwise go unrecognized and untapped.

A strong roadmap will benefit the entire home building industry and its suppliers, as well as government, the home buying public and society at large. PATH is funding the overall program of roadmap development with the expectation that industry will participate actively at its own expense. Yet the result is intended to be a roadmap that reflects *industry's* needs, even though it will include elements that may only be performed by the public sector. Therefore, in addition to simple participation, the roadmapping process will move more swiftly, command the greatest respect and prove most valuable over time to the degree that industry provides visible leadership, shares information, and offers in-kind support such as arranging and hosting meetings involved in the process. Participants will be encouraged and expected to contribute in this way, as appropriate to their role in the overall industry and their capacities to do so.

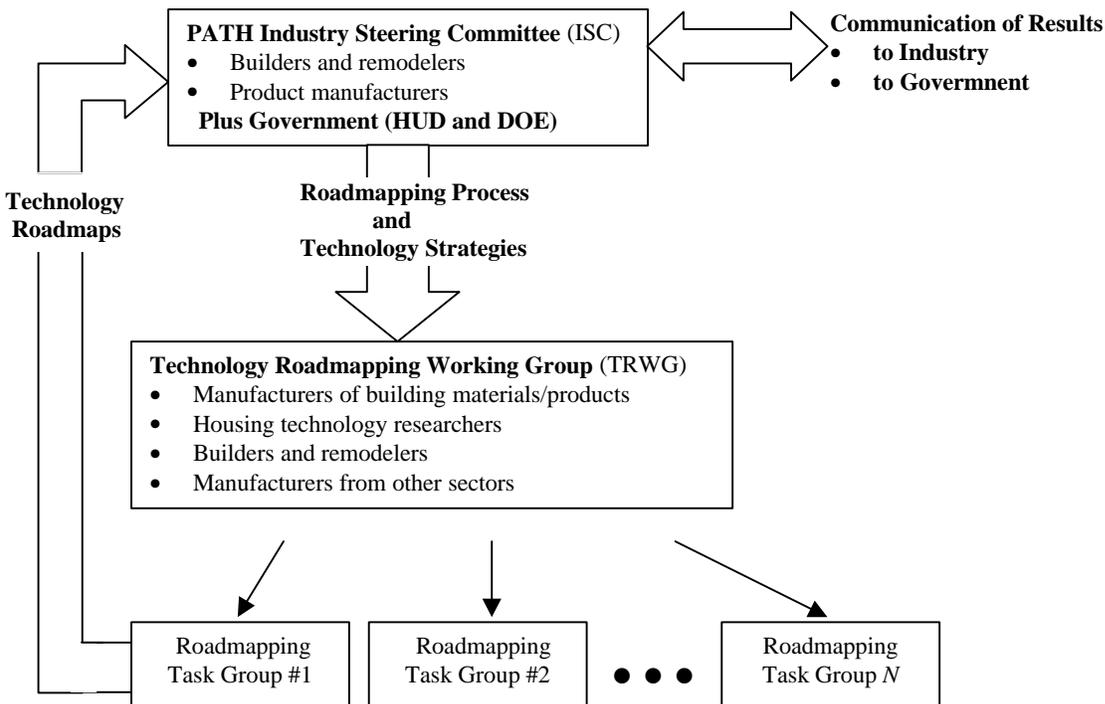
3. OVERVIEW OF THE PATH ROADMAPPING APPROACH

Two groups will be involved in PATH technology roadmapping, the PATH Industry Steering Committee ("ISC") and the Technology Roadmapping Working Group ("TRWG"). Supporting services will also be provided by a Secretariat; NAHB Research Center is serving this role.

The general role of the ISC will be to oversee the roadmapping process, ensuring it is workable, responsive to the PATH goals, includes an appropriate mix of participating firms and skills, focuses on general areas or strategies considered important and potentially beneficial, and leads to outputs that address industry needs. The ISC will also need to consider how the roadmapping relates to other PATH activities, and the industry leaders represented on the ISC will have a key role in communicating roadmapping results to industry and government.

The general role of the TRWG will be to apply creativity, subject matter expertise and rigor in identifying and assessing technological options for achieving broadly defined technology strategies, to identify technology-related barriers that impede or rule out promising options, and ultimately to develop technology roadmaps addressing these barriers and leading up to endpoints representing successful execution of the strategies. Actual roadmap development will be done by Task Groups drawn from the TRWG. Figure 1 below summarizes the roadmapping approach.

Figure 1 -- PATH Technology Roadmapping Approach



Chronological description of the roadmapping approach

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

1. The ISC defines the roadmapping process, commissions the TRWG and identifies its membership, and lays out a set of broad-brush technology strategies as a starting point for

PATH TECHNOLOGY ROADMAPPING

organizing the work of the TRWG. These steps need to be completed expeditiously so the process can move forward.

2. The TRWG:
 - a) meets for a two-day "brainstorming" session to identify multiple technology options responsive to the technology strategies forwarded by the ISC; to assess the likely benefits, development costs, technical risks and time required for each identified technology option; and to identify other technology strategies for potential future brainstorming work,
 - b) uses the assessments to develop a package or 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,
 - c) proposes technology roadmapping Task Groups to develop roadmaps for those technology options that are determined to be high priority, and
 - d) submits its recommendations for roadmapping topics and task groups to the ISC for review and approval

The brainstorming session in 2(a) above is expected to take place during February 2000. The remaining steps leading up to a report from the TRWG back to the ISC will take place during a period of six to eight weeks following the brainstorming session, and are anticipated to make extensive use of web-based tools to gather input from group members.

3. The ISC reviews, directs changes to, and ultimately approves development of roadmaps for high-priority technology options identified during the brainstorming. The ISC commissions Technology Roadmapping Task Groups from the TRWG, and assigns each Task Group responsibility for developing one or more roadmaps. Members of individual Task Groups will be drawn from the original TRWG, 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, 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 makes recommendations about how best to share responsibility for performing necessary work as between industry and government.
5. The ISC reviews and approves individual technology roadmaps developed by the Task Groups or sends them back for further work, and communicates results and recommendations for programs of work based on the roadmaps to the government and to private industry.
6. The TRWG and ISC 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, tasks the TRWG with periodic maintenance or updating of individual roadmaps as required, and periodically reassesses the prioritization of R&D projects incorporated in the roadmaps.

4. PARTICIPANTS IN THE ROADMAPPING PROCESS

PATH Industry Steering Committee

A PATH Industry Steering Committee has already been formed, with members representing the two major private-sector elements of the industry: home builders and building product manufacturers. The ISC is expected to be formally recognized by HUD and NAHB as responsible for steering the PATH program. Current members of the ISC are:

Name	Affiliation
Russell Adams	Masonite Corporation
Bill Asdal	Asdal & Co. Builders
Michael Chapman	Chapman Homes
Roger Glunt	Glunt Development Co., Inc.
Kirk Grundahl	Wood Truss Council of America
Mark Hodges	K. Hovnanian
Don Martin	Martin Development Corp.
Charles Ruma	Davidson Phillips, Inc.
Robert Sahadi	Fannie Mae
Brian Sherry	G.E. Appliances
Glenn Singer	CertainTeed Corporation
Walter Wells	Schult Homes

For the purpose of steering PATH Technology Roadmapping, the above membership will be supplemented by senior public sector managers from two federal agencies: HUD and DOE. These two members will provide representation for and communication with their own and other public sector agencies having stakes in the roadmapping. The public sector members will have a seat at the table and participate fully in ISC meetings where roadmapping matters are considered, but will not be entitled to vote on matters where formal action is taken by the ISC.

Technology Roadmapping Working Group

TRWG members will include private industry and government participants, primarily those involved in developing technologies or implementing them. Participants in this group should represent a broad cross section of the industry, including:

- manufacturers of home building products or materials
- manufacturers from outside the industry (to help think outside the box)
- home builders and remodelers
- home building industry researchers from nonprofits including universities, and
- forward-looking designers/futurists in home building.

The TRWG is envisioned as initially having about 30 members when it first meets for brainstorming in February 2000. Opportunities for participation will grow over time as roadmapping task groups with expanded membership are established under the TRWG. ISC members will be invited to participate in the TRWG, and the ISC will also be able to identify additional persons or organizations to be solicited for participation.

5. FUNCTIONS OF THE PATH ISC AND THE PATH TRWG

PATH Industry Steering Committee

This committee will be responsible for overseeing the technology roadmapping process, guiding it in directions considered promising by industry, monitoring progress alongside the PATH goals, and communicating the results to the private and public sector.

The ISC will have the following responsibilities related to PATH technology roadmapping:

- a) Participate in developing the roadmapping process
- b) Approve the roadmapping process
- c) Develop an initial set of technology strategies for reaching the PATH goals. The technology strategies are broad approaches that are considered to have a high probability of enabling significant progress toward one or more of the PATH goals. Technology strategies should contribute to achieving multiple goals whenever possible
- d) Establish the Technology Roadmapping Working Group (TRWG) and designate the initial membership to participate in a brainstorming session
- e) Review and approve TRWG prioritization of technology options for roadmapping, designation of technology roadmapping task groups, and any additional technology strategies developed by the TRWG
- f) Monitor outputs of the PATH technology roadmap process to ensure responsiveness to industry needs and consistency with the PATH goals
- g) Track private and public sector progress on implementing the roadmaps over time, and communicate results, status and needs to appropriate private and public organizations and individuals, and
- h) Periodically review and re-assess the set of technology strategies that guide the roadmapping and the possible need to update or revise specific roadmaps developed through this process.

PATH Technology Roadmapping Working Group

This group will have responsibility for brainstorming technology options responsive to the technology strategies provided by the ISC and to any additional technology strategies the TRWG might identify, as well as for identifying costs, benefits and risks of the options. Ultimately this work will lead to specific roadmap development activities carried out in Task Groups created under the TRWG. Responsibilities of the TRWG are outlined below.

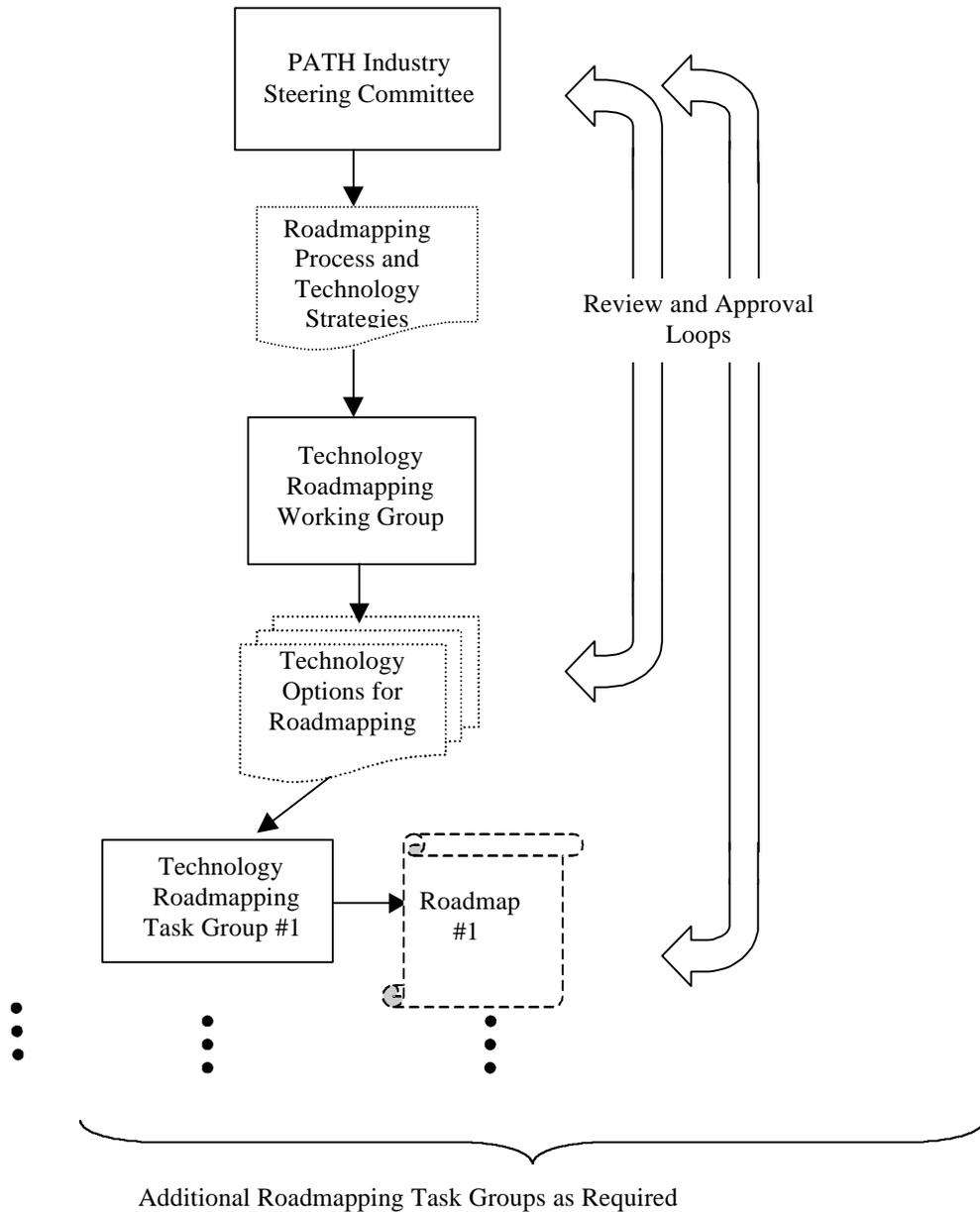
- a) Prior to the first meeting of the TRWG, a white paper will be prepared and forwarded to the members in order to stimulate creative thinking. It is anticipated that the white paper will:
 - summarize the vision to be achieved, as embodied in the PATH goals
 - outline the roadmapping process
 - provide an overview of the current situation in residential housing (both new and existing) as it relates to the PATH goals, and

PATH TECHNOLOGY ROADMAPPING

- describe technology strategies developed by the Industry Steering Committee and suggest technology options consistent with those strategies.
- b) The first session of the TRWG will be a facilitated brainstorming session. Participants will be encouraged to come equipped with their suggestions for technology options in fulfillment of the technology strategies from the ISC, as well as additional technology strategies. It is important that this group devotes adequate attention and resources to developing a broad, thoughtful set of technology options before attaching values and deciding where roadmap development should begin. Therefore, during the brainstorming meeting the group will be charged with identifying and describing technology options, discussing their pros and cons, and perhaps trying to refine and group them.
- c) After identifying technology options, the TRWG will be asked to assign values to key attributes for each option. Key attributes will include:
1. contribution (if any) to achieving PATH goals if successful
 2. likely development cost
 3. probability of success / risk of failure
 4. time horizon for market introduction, and
 5. other attributes as identified.
- d) The results of the brainstorming session will be used to select high-priority technology options that cover a range of time horizons and completion dates. These are candidates for near-term roadmap development. Preliminary estimates of costs, benefits and risks, based on the information collected under c) above, will be developed for these options and Technology Roadmapping Task Groups will be proposed to roadmap those technology options that exhibit the best mix of desirable characteristics. These results will be presented to the ISC for review and approval.
- e) The roadmapping process will expand over time to include new participants identified for specific Technology Roadmapping Task Groups, which will be considered as subcommittees of the TRWG. Members of the individual task groups will be technology experts from manufacturers, academia, trade associations and research organizations. The intention is to have several competing manufacturers participating in each Task Group, each with a real and direct sense of involvement and stake in the results, even though logistical considerations will likely preclude making every member of each Task Group a member of the full TRWG. In addition to the Task Groups formed as a result of step d), a cross-cutting, "breakthrough technology" Task Group may be formed, with participants recruited from outside the home building industry, or similar input may be provided within each of the other task groups. Either method will help provide balance between the likely focus of industry representatives on incremental technology improvements and longer-term opportunities to introduce more radical changes into the design and construction processes.

PATH TECHNOLOGY ROADMAPPING

Figure 2 -- Technology Roadmapping Flow Diagram



The number and scope of technology roadmaps will be proposed by the Technology Roadmapping Working Group and modified (if necessary) and approved by the PATH Industry Steering Committee.

High-priority roadmaps will be developed beginning in mid-2000. Lower-priority roadmap development will be initiated later in 2000, into 2001, and in future years.

6. OUTPUTS OF THE PROCESS

Technology Strategies

The ISC will develop a set of technology strategies representing those areas in either the home building process or the home that could benefit significantly by application of improved product or process technologies, and thereby contribute to achieving one or more of the PATH goals. An example of a technology strategy is provided in Figure 3.

Figure 3 -- Sample Technology Strategy Content and Format

TECHNOLOGY STRATEGY											
INTEGRATED WALL SYSTEMS											
<i>Develop integrated wall systems that reduce on-site labor requirements while maintaining structural performance and improving moisture resistance, thermal performance and quality.</i>											
<p><u>Rationale</u> Shortage of skilled labor is a significant deterrent to timely and high-quality stick-building of walls on site. Errors in framing typically lead to subsequent problems in finishing (e.g. installing cabinets), reduced durability (e.g. flashing details), and increased energy consumption (e.g. poorly installed insulation or caulking). Technologies that reduce the number of components, force correct installation of components, allow off-site assembly of components and others need to be considered. The success of roof trusses is evidence that a systems approach has potential. ...</p>	<table border="1"> <thead> <tr> <th>PATH Goal</th> <th>Benefit Assessment</th> </tr> </thead> <tbody> <tr> <td>Affordability</td> <td>High</td> </tr> <tr> <td>Durability</td> <td>Medium</td> </tr> <tr> <td>Energy/Environment</td> <td>Medium</td> </tr> <tr> <td>Safety</td> <td>Low</td> </tr> </tbody> </table>	PATH Goal	Benefit Assessment	Affordability	High	Durability	Medium	Energy/Environment	Medium	Safety	Low
PATH Goal	Benefit Assessment										
Affordability	High										
Durability	Medium										
Energy/Environment	Medium										
Safety	Low										
<p><u>Preliminary Benefit Analysis</u> Fewer components and/or components that cannot be installed incorrectly and/or factory built wall sections promise significant reductions in cycle time and cost. The cycle time benefits accrue not only from the reduced time to erect the wall, but also from the improvement in quality that will reduce rework and make finishing move faster. ...</p>											
<p><u>Candidate Technology Solutions</u> A number of alternative factory-built panel technologies exist, although their manufacturers are often not exploiting the information and automation technologies available to achieve "mass customization." Technologies also need to be explored that could eliminate steps in the process -- e.g. that integrate components such as insulation, house wrap, vapor barrier, sheathing, interior finish and framing. "Fool-proof" self-flashing windows could be particularly beneficial. ...</p>											

Technology Options

The TRWG will identify multiple technology options based on the technology strategies developed by the ISC and other technology strategies identified by TRWG members. An example of a technology option is provided in Figure 4. Technology options must ultimately be assigned rough estimates of potential benefits, likely costs, development risks and time to completion. These attributes will be used to select priority areas for roadmap development.

Figure 4 -- Sample Technology Option Content and Format

TECHNOLOGY OPTION

FACTORY-BUILT WALL PANELS

Benefit Analysis

Factory-built wall sections have the potential to provide a lower cost, more durable home than a home with conventional, site-built walls. The affordability should be achievable by the economies of scale of building in a factory, while durability should improve because of the improved quality control that can be achieved in a factory environment. In addition, some environmental benefits may be achieved because of reductions in waste and improved control of waste disposal, and energy efficiency improvements should occur because of higher quality installation of materials and/or use of improved materials (e.g. SIPs)

PATH Goal	Benefit Assessment
Affordability	
Energy/Environment	
Durability	
Job Safety	

Candidate Technologies

A number of alternative panel technologies exist, yet these have not achieved significant penetration in home building. These current technologies include:

- Panels built with conventional wood or steel framing
- Structural insulated panels

In addition, new technologies including materials/products and processes need to be considered, such as:

- Innovative materials, e.g. plastic panels, vacuum panels
- Improved mass production techniques and application of automation technology to improve productivity.
- Information technology to allow mass customization

Likely Development Cost

Development costs are primarily those associated with adapting existing manufacturing processes and technologies to the wall construction process. Estimate is \$5M to \$10M to implement a pilot high-efficiency wall panel production factory.

Preliminary Technology Development Risk

Analysis

Various factory-built wall panels are already in production. These include structural insulated panels, as well as conventional stick-built wall sections that are already used by a number of volume builders. The technical risks associated with designing, producing and delivering cost effective, high-quality panels are relatively low. It is probable that many of the high volume, "mass customization" techniques used by other industries (e.g. the automotive industry) would apply here. Probability of technical success is very high. Code approvals are likely not an issue, but market acceptance of unconventional systems may prove problematic.

Type of Risk	Risk Assessment
Technical	Low
Market Acceptance	Medium
Code Approval	Low

Time Horizon

The time horizon for implementing a new, high-efficiency pilot production facility is 3 to 5 years.

Priorities for Roadmap Development

There are likely to be a wealth of candidate areas where roadmapping could theoretically be performed, but all are not equally important and all cannot be pursued simultaneously. Therefore, at a relatively early stage in the process it is important to identify a set of technology

PATH TECHNOLOGY ROADMAPPING

options that are high priority and show promise of enabling significant progress towards achieving multiple PATH goals. The priority set is anticipated to include a mix of short-term, medium-term and long-term technology options, in the hopes that a steady flow of outputs will be forthcoming. The options should range from low cost / low risk / low return to high cost / high risk / high return, since every project has risk and it is unrealistic to think all will succeed. One or more recommended sets of priority options for roadmapping will be created and submitted to the ISC for their review and approval. The result will be identification of multiple technology roadmaps for near-term development.

Technology Roadmaps

A technology roadmap will identify technology endpoints or outputs, as well as the nature and sequencing of activities required in order to reach these end points. Roadmaps may include short, intermediate and even long-term (10-year) milestones. Typically the successive milestones will correspond to increasing benefits, often along with greater technical risk or uncertainty.

Technology roadmaps will provide the following information:

- a) description of specific technology options for achieving the technology strategies
- b) identification of technological barriers and risks that must be overcome
- c) nature, timing and estimated cost of required research and/or development programs
- d) identification and description of current activities or projects included in the roadmap and their funding status
- e) recommended approach for funding research and development based on classification into one of four categories: privately funded, proprietary; privately funded, collaborative (a group of manufacturers); publicly/privately funded, cooperative; and publicly funded, public domain
- f) increased public funding required for existing programs
- g) identification of new R&D and related programs that need public funding, or existing programs that need increased funding in order to contribute to achieving the PATH goals, and
- h) priorities of technology development projects and paths.

Priorities for Technology R&D

The TRWG will evaluate and prioritize the R&D activities included in the several roadmaps based on assessments of risks, costs, benefits, probability of adoption and related factors. This information will be presented to the ISC for final prioritization and development of recommendations for a balanced package or portfolio of R&D projects, demonstrations and related technical work that should be jointly pursued by the government and by other interests participating in the PATH program.

Roadmap Awareness, Dissemination and Maintenance

The ultimate purpose of the roadmaps is not simply to identify needed research, it is also to guide and coordinate a package of public and private R&D projects that will accelerate progress toward PATH goals. The ISC will be responsible for communicating results to policy makers and decision makers in the public and private sectors. It is critical for private industry, elected officials and government agencies involved in PATH all to develop a sense of "ownership" in the

PATH TECHNOLOGY ROADMAPPING

roadmaps as a first step in their eventual implementation. Achieving this ownership will require that all of these stakeholders be aware of, and to the extent possible, contribute to and be actively involved in these activities. This will require significant effort to inform and to obtain feedback via print media and through other mechanisms including the World Wide Web.

An early step in this direction will be a significant public event describing the roadmapping process, documenting progress and summarizing its status. The first opportunity for this will come in Spring 2000, once the individual roadmapping Task Groups and assignments have been identified and new participants are being solicited to focus on specific issues. This is envisioned to take the form of a report to Industry and the White House as part of a larger PATH activity.

Once developed, the individual technology roadmaps will also require ongoing maintenance. The ISC will need to work with the TRWG to review the roadmaps on an annual, biannual or other periodic basis. The purpose is to evaluate technical progress, consider the need for changes in the critical path, and review other factors that can affect the prioritization of future R&D work or the steps necessary for successful execution of any specific roadmap.

7. PROCESS EVOLUTION AND CONCLUSION

The PATH technology roadmapping process set forth in this document should be viewed as a starting point and not the last word. It is expected that, once begun, the process will evolve along with PATH itself. Additional innovative ideas for the roadmapping process that can increase effectiveness, inclusiveness and transparency will continue to be explored and adapted for use as appropriate. Some possibilities under consideration include targeted interviews with key players at an early stage in the process, use of the Internet to disseminate information and as a vehicle for collaboration to reduce the need for meetings, and development of analytical tools that can assist with evaluating alternative R&D paths in the face of considerable uncertainty.

Technology roadmapping is not the only element in PATH, nor is it the sole route to program success. However, it is a key part, and possibly the most important part, of the overall picture. In the near term, successful roadmapping will help to steer resource allocation and bring the PATH goals within reach. Over time its impact may be much greater. The diversity of goals and the breadth of technologies that can help to achieve them strongly suggest that PATH technology roadmapping will ultimately have a far-reaching impact on the shape of housing production, not just over the next ten years but long into the 21st century.

PATH TECHNOLOGY ROADMAPPING

PATH Technology Roadmapping Schedule

Month Milestones	Nov. 1999	Dec. 1999	Jan. 2000	Feb. 2000	March 2000	April 2000	May 2000
Draft of Roadmapping Process to ISC		▲					
Drafts of Technology Strategies to ISC		▲					
ISC Meeting at Int'l Builders Show			▲				
ISC Approval of Process and Strategies				▲			
White Paper to TRWG				▲			
Brainstorming Session of TRWG				▲			
Technology Options Prioritized					▲		
Technology Portfolios to ISC						▲	
Initial Roadmapping Efforts Identified							▲
Report to the Industry & the White House							▲
Recruitment of Roadmapping Participants						▲	→
Kick Off Roadmapping Task Groups							▲