

Introducing **Innovation** into the Home Building Industry

advice for innovators and inventors



U.S. Department of Housing and Urban Development
Office of Policy Development and Research



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Prepared for
U.S. Department of Housing and Urban Development
Office of Policy Development and Research

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Overview

The residential home building industry is an important sector of the U.S. economy. Unfortunately, it has not shared the productivity gains experienced by other industries, in part due to a lack of innovation. Government studies and university research indicate that the structure of the housing industry is an impediment to the adoption of innovation.

To help counter this trend, the Partnership for Advancing Technology in Housing (PATH) has sponsored several studies to better understand the process of innovation in housing. PATH recognizes that innovation is important to the housing industry in making homes more affordable, durable, and energy efficient.

This guide is the result of a Technology Transfer study of selected innovations and partnerships between inventors, innovators, and manufacturers. It contains information gathered through interviews, focus groups, case studies, and independent research, and provides insights for readers who have an invention or innovation to commercialize in the housing industry.

An Industry Overview

The home building industry represents a unique market opportunity for innovators, as the housing market is one of the largest market segments of the economy. In 2006, the combination of private investment and consumption spending on housing constituted 16% of GDP (see Table 1). Despite the presence of several large national players, the industry is still dominated by small- and medium-sized builders and typified by an industry association that retains a 1,000+ member board. Materials, labor, and building practices differ according to geography; multifamily or single-family; new and remodel; factory-built, modular, or site-built; production, semi-custom, or custom; and builder size.

In such a multifaceted market, assessing an innovation's chance of success can be challenging. Even identifying the customer can be challenging! Potential customers include manufacturers, homeowners, contractors, builders, or architects – any one of whom may specify construction

Table 1
2006 – Housing Components in GDP (Billions of Dollars)

Gross Domestic Product	\$13,194.70
Gross Private Domestic Investment	2,209.20
Fixed Investment	2,162.50
Nonres Fixed Investment	1,397.70
Nonres Structures	405.10
Nonres Equipment & Software	992.60
Residential Investment	764.80
Share of GDP	5.80%
Share of Gross Private Domestic Investment	34.62%
Residential Structures	755.20
New	657.00
New Housing Units	476.40
Permanent Site	469.00
Single-family Structures	416.00
Multifamily Structures	53.00
Manufactured Homes	7.40
Improvements	178.50
Other	2.10
Broker's Commissions on Sale of Structures	101.50
Net Purchases of Used Structures	-3.40
Residential Equipment	9.60
Personal Consumption Expenditures	9,224.50
Durable Goods	1,048.90
Nondurable Goods	2,688.00
Services	5,487.60
Housing Services	1,381.30
Share of GDP	10.47%
Share of Personal Consumption Expenditures	14.97%
Owner-occupied Nonfarm – Imputed Space Rent	1,014.50
Tenant-occupied Nonfarm – Rent	277.00
Rental Value of Farm Dwellings	14.80
Other Housing Services	75.10
Residential Investment + Housing Services	2,146.10
Share of GDP	16.26%

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis.

products depending on the individual application. Most innovations will enter the market through a specific sector within the home building industry, commonly referred to as a market niche. Identifying the specific target for your innovation's market entry is the key to success. Case studies of industry innovations have demonstrated that understanding and addressing the demands and concerns of the target customer early in the design phase are critical to timely and successful product design and development.

For the inventor who is new to the home building industry, a wealth of resources are available to assist with understanding industry regulations, opportunities, and challenges. Sources of information include industry-wide associations that are dedicated to specific building systems, products, or the industry as a whole; government research and demonstration programs; and trade journals. Table 2 provides useful resources at the end of this report.

Assessing the Market

Once you have gained a basic understanding for how the industry functions, you should identify your target market. The first step is determining how your innovation compares to alternatives in meeting market needs. Once you have gone through this exercise yourself, you might consider arranging market studies or focus groups of individuals who would interact with your innovation. Such industry participants can provide invaluable feedback on its marketability. Key topics to consider include:

- **Ease of Use and Adaptability:** installation tools, time, and learning curve; maintenance; coordination with trades and other critical players (e.g., a wall system must accommodate the activities of electricians, plumbers, siding installers, insulators, and framers); disposal.
- **Start-Up and Lifecycle cost:** shelf price, cost of installation, maintenance costs.
- **Performance and Maintenance:** durability (shipping, construction, and lifetime performance phases); impact on resources (e.g., energy and water efficiency).
- **Safety and Security:** building code and regulatory compliance, and perceptions of relevant parties.
- **Environmental Impact:** current and anticipated regulatory compliance, lifecycle analysis of environmental impacts from material sourcing through product disposal ("cradle to grave" analysis).
- **Overall Perceptions:** regulatory/code officials, home owners, trades, home builders.

It is important to recognize that the home building industry is slow to adopt new technologies and that the initial costs of these innovations can be substantial. The further a technology departs from market familiarity or lowest first costs, the more challenging market adoption will be. A thorough market analysis can help you avoid costly mistakes and common pitfalls that result from a lack of understanding of how the innovation will affect all stakeholders involved in the commercialization process. The value of obtaining and responding to feedback of potential customers early in the design phase cannot be overemphasized. Note that it is a good idea to protect your innovation by obtaining a provisional application for patent and non-disclosure agreements before revealing too much through focus groups or other market research. The bottom line is that a number of disparate groups must agree that the innovation adds value to the home building process.

IDENTIFYING AND ASSESSING MARKET DRIVERS: CODES, PRODUCTIVITY, FUNCTIONALITY

Building codes and regulation play a major role in the home building industry. Many innovations come to market or gain market share because of building code requirements. Examples include:

- **Hurricane Resistant Glazing** – Adopted by the codes for defined areas of the United States in the aftermath of Hurricanes Andrew and Hugo
- **House Wraps** – Tyvek® and other house wraps existed before being mandated by the codes, but gained substantial market share through code requirements on infiltration

- Ground Fault Circuit Interrupters – Adopted to prevent accidental electrocution

The International Code Council (ICC) family of codes (I-Codes) contains over a dozen codes that may be applicable to particular jurisdictions depending on local adoption. The International Residential Code (IRC), applicable to detached one- and two-family dwellings and town homes up to three stories in height, and the International Building Code (IBC), which applies to all other new construction, are the general codes that pertain to the residential building industry. The grant of a code approval is the first step toward market acceptance of an innovation, but the battle for regulatory approval does not always end there. For example, air admittance valves (AAV), innovative plumbing system components that eliminate the need for a vent pipe and roof penetration, are approved within the 2003 IRC. However, some local code officials have opposed these valves due to lack of product familiarity, causing their jurisdictions to prohibit them.

If your innovation does not satisfy code requirements in its current state, consider design refinements that will result in compliance. Alternative options involve seeking code approval of an individual product through the ICC Evaluation Service or proposing a code change to the I-Codes themselves. Potential business partners will want to know how your innovation relates to the code. It can be prudent to design an innovation from the beginning so that it complies with codes, as innovations that fall outside of the code may require additional time and financial resources. As dull as they may be to read, codes are living documents, under constant revision and maintenance, and inventors need to be aware of their influence on innovation.

Building codes define minimum standards for building practices and systems. Some products and systems installed in homes meet only these minimum standards. If your product exceeds code requirements, it must provide enhanced value, such as productivity improvements or added functionality. Productivity improvements are those that decrease input costs or increase cost effectiveness by saving labor, time, or materials. Functionality improvements generally are those that increase livability, comfort, health, usability, or durability. Recognizing where your product fits is key to market positioning. Some products may improve both productivity and functionality.

UNDERSTANDING BUILDING CODES

International Residential Code (IRC)

- Applicable to detached one- and two-family-dwellings and town homes to three stories in height.
- Functions as a single source for all building and systems within its scope.

International Building Code (IBC)

- Applies to all commercial and residential buildings not covered by the IRC or International Existing Building Code.
- Commonly references other regulatory codes, such as the International Plumbing Code, the International Mechanical Code, and the International Energy Conservation Code.

Also, be aware that individual states may adopt and amend the I-Codes to satisfy state-specific standards for building that can arise from durability initiatives or energy efficiency goals. See www.iccsafe.org for more information.

LOOK FOR MARKET OPPORTUNITIES

Understanding what is happening in the housing market can help you identify and focus on key opportunities. For example, many industry experts believe that the slower part of a housing market cycle is actually the best time to introduce an innovation.

If your innovation includes environmental features, consider “code-plus” programs as an approach to marketing your innovation. These programs often focus on energy efficiency, durability, indoor air quality, or “green building” – the practice of environmentally responsible and sustainable building, design, and construction. Most current green building programs, such as LEED for Homes and NAHB’s Green Home Building Guidelines, award points to different products and systems based on their perceived environmental impact. At the heart of most green building programs is the EPA’s Energy Star qualification. The Energy Star is the most recognized label in the consumer market.

Affordable innovations that assist builders in meeting these programs' objectives stand to capitalize on one of today's fastest growing segments of home building – the green building market. A recent survey has found that the primary reason home buyers would be motivated to purchase a green home is the knowledge of the health benefits associated with these homes, pointing to market demand for greener, healthier products.¹

The best time to advance innovation is during a housing recession when builders are looking for something to make their product distinctive. When the housing market is booming, builders are likely to be resistant to innovations that might slow down their standardized processes. To be successful, innovations must be sensitive to market timing.

—PATH Study, *Overcoming Barriers to Innovation in the Home Building Industry*, 2005

Market Timing: Sometimes you just need to wait!

A small company out of Kennewick, Washington, Infinia developed a long life Stirling engine for applications in the space industry. In a textbook case of technology transfer, Infinia partnered with a Japanese firm to integrate their engine into a residential micro combined heat and power unit (mCHP) that can function as a mini-power plant for the home – providing space heating, water heating, and electricity. The unit possesses the advantages of being energy efficient and very quiet to operate while having the potential to act as a backup power source during grid failures. Micro CHP (mCHP) units are finding great success in Japan and Europe where regulatory incentives and a favorable natural gas to electricity price ratio are driving the market. Unfortunately, the U.S. market for mCHP is likely to remain constricted unless market incentives are established.

COMMUNICATING YOUR INNOVATION'S ADVANTAGE

The results of your market assessment should guide the way you communicate the advantages of your innovation. Give thought to how to quantify and communicate the lifecycle costs and benefits of your innovation. Communicating cost comparisons between highly innovative systems and their market alternatives can be very challenging. For example, it may be difficult for a builder to conceptualize how cost

effective it is to specify a wall system that incorporates insulation, framing, and electrical wiring versus a traditional wall system where these costs are spread over various trades. Realize that products with higher or unknown first costs will be a harder sell, but that productivity or functionality improvements may be sufficient to make your product marketable and could yield long-run cost-saving benefits. Regardless of your product, understanding and communicating its benefits in a way that is relevant to the market are critical to selling it.

The Commercialization Timeline

Inventors frequently make the mistake of underestimating the time required to commercialize a new product. At a roundtable discussion held with manufacturers and innovators at the 2007 International Builders Show, participants agreed that inventors can expect that commercializing a new technology will take 5-6 years when everything goes as planned. Further, participants agreed that the minimum time required to introduce a new technology to market is 3 years. Although these guidelines have been found to be fairly consistent and repeatable rules of thumb, individual experiences can vary significantly. Factors that can lengthen or shorten the commercialization time include the degree of complexity of the product, the source or ownership of the innovation, the qualifications and testing required, and the market's readiness to accept the new product.

For example, Leviton, a leading North American innovator and producer of electronic products, often succeeds in bringing products from concept to production in 6 months. At the opposite end of the spectrum, the Lawrence Berkeley National Laboratory's Environmental Tech Division (LBL) has been working on research, development, and commercialization of its innovative product, the Integrated Window and Wall System (IWWS), for over 14 years. In this instance, the disparity in the length of the commercialization process can be attributed to two factors: the Leviton innovations often are line extensions of previously commercialized products within previously commercialized systems, while the LBL IWWS is an innovative new concept (sometimes referred to as

¹ Robert Charles Lesser & Co. (July 17, 2007). "Building Green TV and RCLCO Reveal that Health is the Most Powerful Motivator for Consumers to Build or Buy a Green Home," http://www.rclco.com/pdf/Jul172007521_Press_Release_RCLCO_and_Building_Green_TV.pdf.

a disruptive innovation) that requires modifications to building processes. Additionally, manufacturer innovations are motivated by a return on investment whereas a government laboratory research innovation serves a public purpose or research purpose and may not be driven by profit or schedule. In this way, government laboratory innovations and university innovations are similar.

PROTECTING YOUR INNOVATION

The introduction of an innovation requires intellectual property protection to prevent an infringement and to allow manufacturers the appropriate ability to control the technology. Patents are an integral part of preparing for partnering with manufacturers, as they grant the patentee the right to prohibit others from manufacturing or selling their patented innovation. Patents are granted only to innovations that can be shown to be novel, useful, and non-obvious.

Before applying for the right to protect your innovation, initiate a patent search to determine if your innovation is eligible. The University of Texas provides an excellent online tutorial for this process (see Table 2), or you can always hire a professional patent agent or attorney.

Once you have determined that your innovation is eligible to be patented, consider submitting a “provisional application for patent,” which is affordable and requires minimal filing procedures. In order to pursue intellectual property (IP) protection rights, filing a design or utility patent must occur within one year of filing of the provisional application. It’s a good idea to enlist a patent agent or attorney registered to practice before the U. S. Patent and Trademark Office (PTO) to review or produce this application for you. It also is important to note that to a patent agent or patent attorney, “innovation” implies patentability, so “patentable innovation” is somewhat redundant. cursory options for IP protection rights are given below. For detailed information on any of the following, refer to the U.S. PTO website (www.uspto.gov).

- **Provisional Application for Patent:** For many inventors, the first step in the patenting process is filing a provisional application for patent. Filing a provisional application for patent provides a quick, inexpensive way to share your idea with potential

partners without fear of others stealing your idea and leaving you without legal recourse. Upon filing a provisional application for patent, you have 12 months to apply for a utility patent. A provisional application provides some IP protection, but is not enforceable. The words “patent pending” can be used to provide notice to competitors that a patent application has been filed but provides no legal rights.

- **Utility Patent:** Obtaining and maintaining a utility patent is more expensive than filing a provisional application for a patent, but a utility patent protects the rights to the product’s specific physical characteristics and its applications for a period of 20 years from the filing of the provisional application, or from filing of the utility application if no provisional application was filed.
- **Design Patent:** Design patents address the appearance of a product. If the product’s appearance is original and is a significant component of its marketability, consider filing for a design patent. If acquired for your innovation, a design patent provides the right to protect the physical appearance of an innovation for up to 14 years.
- **Patent Cooperation Treaty International Application:** The Patent Cooperation Treaty (PCT) application process was established to simplify the process of obtaining international patents in participating countries. If your market assessment concludes that opportunities for commercialization exist in international markets, the U.S. PTO and World Intellectual Property Organization (www.wipo.int) provide resources to help you pursue international protection. International patents can be very expensive to pursue but could also produce valuable returns.

Other tools that support IP protection include trademarks to prohibit the use of an innovation’s name or symbol by others; copyrights to protect software or multimedia works; and trade secrets to protect an innovation’s formula or composition. If your innovation will achieve a large market share, these tools could be as important as obtaining a patent.

Developing Partnerships or Venturing: It's Your Decision

Once you have conducted the necessary market research, developed an understanding of the pressures of the regulatory environment, evaluated the expectations of your potential consumer base, and done your homework on the competition, you have set the stage for the commercialization of your innovation.

A key decision is whether to license your product to an established manufacturer or to establish a start-up business to commercialize and manufacture your innovation yourself. The choice could have significant impact on the success of your product in terms of both market penetration and realized financial rewards. In this section, you will find guidelines for selecting the best approach and information about what to expect on each path.

COMMERCIALIZING YOUR INVENTION THROUGH VENTURING

Many inventors choose to form start-up companies to commercialize their product when they feel they have sufficient funding and are well prepared for the task at hand. This is sometimes referred to as "venturing." Venture capital can come from private or public sources. Some of the benefits of venturing include:

- It is often a more exciting and challenging approach than forming a licensing partnership;
- You have greater control over how the technology is commercialized and eventually managed; and
- There is far greater potential for rewards, both financially and in a sense of achievement.

The challenges are significant, but with the right approach – which involves thorough research and planning and being open to learning from the experience of others – success is definitely achievable.

When establishing a start-up company, it is necessary to establish an appropriate team. The team must be able to

both innovate and transfer technology. An effective team should include professionals with technical, financial, legal, and market research expertise.

Having a team with one or more professionals with strong financial backgrounds is critical to the success of your venture. Your needs will vary based on your business plans and your product, but it is important to have expert legal resources for ongoing patent and contractual issues. The scope and strength of the required marketing team will vary based upon the business plan and level of innovation. As a manufacturing business, your start-up company will need to retain marketing functions or partner with others to continue market research and monitoring. The marketing team must be able to clearly identify a market need, effectively communicate the value of the innovation, and establish distribution channels or partners.

You may form your team using existing employees, hiring new staff, or through a subcontracting agreement. Your team will need to further establish relationships and partner with third-party subcontractors to provide raw materials as well as to distribute final products. For further guidance on the manufacturers' side of the commercialization process, refer to the HUD Publication, *New Product Adoption in Housing: Guidance for Manufacturers*.

Assuming that you already have protected your intellectual property rights by patenting your innovation, the next step is to develop a baseline understanding of the commercialization process. You will need both a commercialization and a business plan.

By one estimate, only 31 percent of new small businesses survive more than 7 years.² By numbers alone, the disadvantages of venturing tend to outweigh the advantages. However, venturing is not about the number of hurdles you'll have to overcome. Instead, it is about your desire – and more importantly, your commitment and resources – to successfully build a business around your innovation.

² SCORE. (2008). Small Biz Stats & Trends. (www.score.org/small_biz_stats.html)

LICENSING PARTNERSHIPS

A licensing partnership is a relatively simple, low-risk linkage with a manufacturer that allows the inventor to “enter” new markets. The licensee (the manufacturer) is given the right to use a process, trademark, patent, or other proprietary item for a fee or royalty. Inventors may have a number of reasons for licensing their technology to others rather than pursuing a venture. These include:

- Low level of success for new business start-ups (although proper preparation and planning can increase your likelihood of success);
- Reduced need for appropriate equipment and facilities;
- Reduced need for capital;
- The investment of time and effort required to start and operate the business, secure, and manage needed resources, etc.;
- The challenge of overcoming barriers to market entry in industries that do not welcome new entrants (see “*Overcoming Barriers to Innovation in the Homebuilding Industry*,” <http://www.huduser.org/publications/destech/OverBarriers.html>); and,
- Likelihood that you, the technology innovator, will have little time for additional research and development if you devote most of your time to marketing and commercialization.
- Improved efficiency, if the licensee is an established manufacturer;
- Brand/name recognition, if the partner is well known to the industry;
- Product similarities and synergies, if the innovation extends the partner’s product lines; and
- Resource pooling, if the partner brings additional resources to the partnership.

The experience that manufacturers bring to the business of commercializing can offer significant advantages to inventors new to commercialization and mass production.

In effect, this path takes advantage of specialization and economies of scale, as inventors can concentrate on innovating and manufacturers can concentrate on commercializing. The brand or company name recognition of established manufacturers helps to ease the market’s natural resistance to new products. For example, a new home heating technology carried under a brand name such as Carrier or Lennox would have a much higher chance of market acceptance than the same technology under a new and unproven corporate identity. In some cases, partnership with a manufacturer will be suggested by the innovation’s similarity to other products and the fact that many innovations are sold as components of larger subsystems.

An example is Perfect Glaze, a hurricane resistant sealing for window glazing developed by the National Starch and Chemical Company. Once the sealant was developed, the National Starch and Chemical Company decided to contract with TruSeal Technologies Inc., a supplier of various glazes and sealants, for the marketing and distribution of their product. This alliance has proven very beneficial because TruSeal is the leading supplier of glazes and sealants for 7 of the 10 largest window manufacturers in the nation. With an established distribution system for products similar to Perfect Glaze, TruSeal has been able to help Perfect Glaze achieve a larger market share at a faster rate than otherwise possible.

It is possible that a partner may engage in a partnership to “freeze” a potential innovation. This could allow the larger manufacturer to field a competing product without the threat of competition.

Resource pooling offers a particularly beneficial opportunity to partner with manufacturers, as most inventors have limited financial and labor resources at their disposal. Manufacturers that have a vested interest in the success of your product, such as a manufacturer that supplies components for your innovation, will have strong motivation to promote the success of your product. The pooling of financial and labor resources is likely to lead to greater success than either partner would have individually.

Typical Contracts

When negotiating a contract with a potential partner it is important to pay close attention to the structure of the licensing agreement, which will vary depending upon the innovation's stage of development as well as its marketability. You likely will need to enlist the help of a licensing expert and legal counsel due to the complexity of license contracts. Nevertheless, your initial considerations for the license structure should address the following:

- **Exclusivity:** Consider licensing by region, end-use, or market to allow for optimum market penetration. For example, Infinia licenses their Stirling engine to multiple markets. This has enabled them to partner with manufacturing leaders in Asia and Europe to increase commercialization overseas, while their North American license remains available as the market matures.
- **Payments:** Estimate upfront fees, maintenance fees, and continuing revenues or royalties.
- **Flexibility:** How will the license address industry, corporate, and product changes?
- **Liability:** Determine liable parties, extent of liability, etc.
- **Protection:** Safeguard trade secrets and patent enforcement rights.
- **Incentives for Development:** Your payments are going to be tied to the innovation's successful commercialization, so ensure that the contract is structured to encourage this. Options include annual licensing fees and establishing and requiring that milestones be met to retain a license.
- **Expectations:** Manufacturer licensees typically receive the lion's share of sales profits due to the risk they assume. As an inventor who is licensing an innovation, expect the licensee to pay out royalties of 0.5% 25% of net sales, depending on the innovation's stage of development and its ability to stand alone. (e.g., Is it a small component of a larger system or a full system unto itself?) Upfront and annual payments vary widely according to the innovation and the size of the licensee and may take the form of equity ownership in a small or start-up company.
- **Termination:** Clearly define conditions of termination that will both protect your interest and encourage commercialization.

Case Study: Purfect Glaze – Hurricane Resistant Sealing for Glazing

TECHNOLOGY SUMMARY

This product class is relatively new and was created to limit the damage to buildings caused by hurricane force winds and impacts. Building codes, such as the International Residential Code and the Florida Building Code, now require window systems to meet rigorous standards for design pressure and impact resistance.

By using Purfect Glaze to bond glass to framing, window manufacturers have been able to meet the impact resistance requirements of code-referenced standards. Besides improving product performance by using Purfect Glaze, manufacturers also can benefit from reduced production time, improved production efficiencies, and total cost reduction.

TECHNOLOGY SOURCE

The National Starch and Chemical Company developed Purfect Glaze. The company is based out of Bridgewater, New Jersey. National Starch manufactures three types of warm-applied sealants for windows and doors. The Purfect Glaze sealant is available for general application and high-strength use.³ National Starch, with sales of over \$3.5 billion, is part of a larger group, Imperial Chemicals Industries (ICI), and has substantial resources for technology development.

CURRENT STAGE OF DEVELOPMENT

Despite its significant size and influence, the National Starch and Chemical Company is not well known in the window industry. Recognizing this, they have strategically partnered with TruSeal Technologies, Inc; which is a leading supplier of warm-edge, insulating glass sealant spacers for windows and doors for the world market. TruSeal will market, sell, and distribute the sealant to window manufacturers in the United States.

Based in Beachwood, Ohio, TruSeal has been in the insulating business since the late 1960s and offers a wide variety of insulating glass spacer technologies and accessories that meet the demands of insulating glass fabricators. TruSeal is the preferred supplier for 7 out of 10 of the largest window productions in North America.⁴

Purfect Glaze has been successfully assimilated with TruSeal's product line. TruSeal now offers three types of Purfect Glaze (G, H, and SA): Purfect Glaze G is a high-green strength sealant specifically formulated for back-bedding IG units; Purfect Glaze H is a high-ultimate strength back-bedding sealant specifically formulated to pass impact resistance standards; and Purfect Glaze SA is formulated for high-green strength in glazing applications of larger IG units, such as patio doors and large picture windows.

LESSONS LEARNED

Commercialization can happen smoothly when a new product meets a clear need. With the changes in building codes for wind events and hurricanes, glazing came under increased pressure to improve. Safety issues are also a huge benefit of these adhesives and sealants. When incorporated with glazing, the adhesives are a good product for impact and hurricane resistance because they absorb shock and are more flexible than mechanical attachments. Furthermore, Purfect Glaze promises improved production efficiency and reduced costs for the manufacturer. Thus, Purfect Glaze addresses the needs of multiple stakeholders, from manufacturers to homebuilders to homeowners.

TruSeal was a good choice for the manufacturing of Purfect Glaze's hurricane resistant seal because the product incorporated well with TruSeal's product line. The partnership allowed Purfect Glaze to reduce resources devoted to market development and overcome the barriers to market penetration through its advancement of effective partnerships with a well-recognized and regarded distributor within its market niche.

³ National Glass Association: Window and Door (www.windowanddoor.net)

⁴ To learn more about the Purfect Glaze system, visit TruSeal Technologies (www.truseal.com)

MANUFACTURERS' EXPECTATIONS

Before contacting manufacturers, it is essential that you understand what manufacturers expect of innovators. Since there usually are several inventors in the market striving for commercialization of their product, it is important that you be fully prepared to comply with the expressed needs of the manufacturer. Most manufacturers will request specific information from inventors prior to an initial meeting. Manufacturers will also require that the product be appropriately patented (as described above) and that the product be one that fits closely within the manufacturer's segment of the housing market.

Most manufacturers will expect you to have prepared both technical and market research data. Before approaching a manufacturer, you should have compiled technical performance data as appropriate for your innovation. Manufacturers also will want preliminary information regarding anticipated costs associated with the manufacture, utilization, and maintenance of the product. Although not all manufacturers expect market research from innovators, most expect a minimum of preliminary market research. Market research is valuable for inventors to be able to estimate the value of their technology. However, many large manufacturers recognize that some small inventors cannot obtain this information because of their limited resources. Manufacturers may compensate for this lack of information by conducting their own market research before agreeing to commercialize a product. As an inventor, be sure to conduct the appropriate market research to ensure that you are contacting the right manufacturers and that your product fits well with their currently established product line or target market.

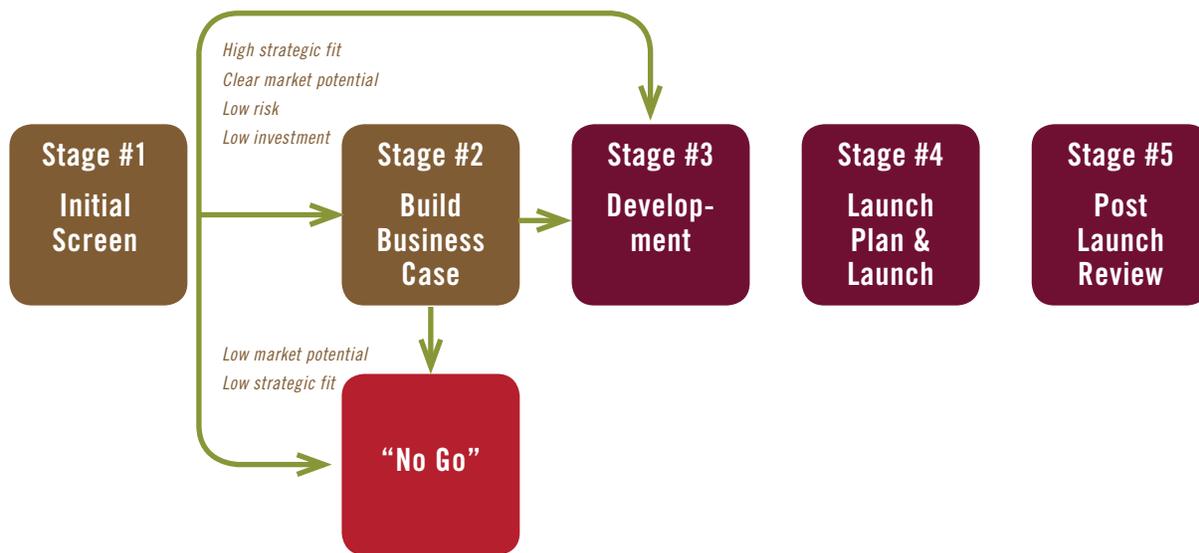
It is common for inventors to be cautious when partnering with large manufacturers, but don't let caution get in the way of commercial success. Small innovators often require restrictive confidentiality agreements from manufacturers that prohibit the manufacturers from sharing the necessary information across internal divisions. Be sure to protect your intellectual property rights through the appropriate utility or provincial patents, but when possible avoid overly restrictive confidentiality agreements that hinder the process.

Manufacturers are eager for "home run" ideas that promise to yield immediate returns on investments or "breakthrough" inventions that are novel and bring innovative ideas to the attention of the marketplace. A manufacturer will spend considerable resources introducing the new idea or invention. Licensing the technology is just the first step in the commercialization process.

It is important to fully evaluate your market research and analysis to most accurately predict the length of time required for commercialization of your specific product. The staged-gate development process is commonly used by manufacturers. The chart in the next page presents the stages that you should pursue as you proceed with the commercialization process. The typical staged-gate process tracks decision-making regarding development of a particular idea from "initial screen" to "post-launch review."

Figure 1
Staged-Gate Development Process

Source: *Winning at New Products: Accelerating the Process from Idea to Launch*; Cooper; 2001



Resources

The commercialization of your innovation is an extensive and costly process that can be overwhelming to an inexperienced and financially constrained inventor. Fortunately, there are several resources available to assist with your financial and reference needs.

FINANCIAL RESOURCES

Several federal and state programs provide targeted funding for the support of innovations in the housing industry. Federal programs and processes can be easier to navigate and less restrictive than state programs. They are known to be more accessible and not as onerous and restrictive as the state grant programs, although state programs with significant funding are also available if you are willing to put in the extra work. Examples of state energy programs that offer grants are the New York State

Energy Research and Development Authority (NYSERDA) and the California Energy Commission (CEC). Both can have high cost of entry in terms of time and resources, and may have restrictions based on business size, ownership, and location. Some programs may require royalties to be paid as well. National-level funding opportunities are sometimes available specifically for housing industry-related innovations through the U.S. Department of Housing and Urban Development, the National Science Foundation, and the Forest Products Laboratory, among other resources. Specific to promising energy-saving ideas and innovations, the U.S. Department of Energy offers financial and technical support to inventors and businesses through its Inventions and Innovation (I&I) Program. I&I selects technologies to receive grants through a competitive process. The Small Business Innovation Research Program and Small Business Technology Transfer Program are also sources of funding (see sidebar on next page).

Although there are significant funds available through government entities, inventors often need to seek outside sources of funding to complete the R&D and marketing necessary that results in effective development and ultimate commercialization of their technology. Incubator programs through universities, government, or private sector non-profits offer alternative sources of support that are widely accessible. In fact, the National Business Incubation Association reports that the United States had 1,115 incubation programs as of 2006. Most of these programs are run by non-profit organizations with funding from economic development organizations, but may vary substantially in their operation and in the types of entrepreneurs that they serve.

Before you enlist the services of an incubator, determine whether there's a good fit. What is the organization's success rate? How long do innovators generally spend in the program (typically 3 years or less)?⁵ What is the innovator's experience in the particular industry and with products similar to your innovation? What level of support will be provided?

Local incubator programs can provide valuable assistance to entrepreneurs in the earliest stages of business development and innovation commercialization by offering services related to securing and managing loans, providing introductions to "angel" investors and venture capital investors, and developing materials necessary to communicate the value of your venture. The level of information required by investors will vary according to their familiarity with the subject matter and their commitment of capital.

SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)/ SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM (STTR)

The SBIR and STTR are government-sponsored programs that encourage small businesses and researchers to explore their technological potential by providing incentives to the research and advancement of new technologies. Funding from both the SBIR and STTR programs is available through various government agencies, including the U.S. Department of Defense, the U.S. Department of Energy, and the U.S. Department of Health and Human Services. Both the SBIR and the STTR are 3-phase programs structured as follows:

- **Phase I: The Start-Up Phase.** In this phase, small businesses are eligible for awards of up to \$100,000 for approximately 6 months to assess the scientific and technical merit or feasibility of an idea or technology.
- **Phase II: R&D Work:** In this phase, small businesses are eligible for awards of up to \$750,000 for a two-year evaluation of the results from Phase I. During this time, the researcher performs the R&D work, and he or she evaluates the potential opportunities for commercialization of the technology.
- **Phase III: Technology to Market:** The results generated from the Phase II evaluation moves from the laboratory into the marketplace. Unfortunately, there are no SBIR or STTR funds available to support this phase. The small businesses and researchers must find funding in the private sector or other non-SBIR/STTR federal agency funding.

To be eligible for funding under the SBIR program you must be an American-owned, independently operated for-profit business with less than 500 employees, and your principal researcher must be employed by the business. To be eligible for funding under the STTR program you must be a small business meeting all the requirements of the SBIR program or a qualified non-profit research institution. Although there is no size limit for non-profit research institutions, in order to be eligible these institutions must be located in the United States and be a non-profit college or university, a domestic non-profit research organization, or a federally funded R&D center. Further information regarding the SBIR and STTR programs is available on the U.S. Small Business Administration website at www.sba.gov/SBIR. SBIR seems particularly appropriate when the federal agency is in a position to procure the products that reach the market in Phase III.

⁵ National Business Incubation Association (www.nbia.org)

OTHER RESOURCES

For your other industry-related research or data needs, Table 2 identifies some useful resources.

Table 2
Helpful Resources for Inventors

Industry Sector	Organization	Type of Resources Available	Website
Academic	Advanced Technology Development Center	Support for Entrepreneurs	www.atdc.org
Academic	Joint Center for Housing Studies	Economics and Industry Research	www.jchs.harvard.edu
Academic	National Collegiate Inventors and Innovators Alliance	Business Planning, Commercialization Plan	www.nciia.org/r_primer.html
Academic	University of Texas	Patent Search Tutorial	www.lib.utexas.edu/engin/patent-tutorial/index.htm
Building Codes	International Code Council	Building Codes Product Evaluation Service	www.iccsafe.org
Federal Government	Department of Energy	Inventions and Innovation Grants	www1.eere.energy.gov/inventions
Federal Government	Department of Housing and Urban Development	Research on Innovation and Technology Transfer, Annual Housing Survey	www.hud.gov www.pathnet.org
Federal Government	National Science Foundation	Venture Capital	www.nsf.gov/eng/iip/sbir
Federal Government	USDA Forest Products Laboratory	Research, Venture Capital	www.fpl.fs.fed.us
Non-Profit	SCORE	Business Advice and Training	www.score.org
Publisher	Nolo	Legal Counsel	www.nolo.com
Publisher	The Licensing Journal	Licensing	www.aspenpublishers.com
State Government	California Energy Commission	Research, Venture Capital	www.energy.ca.gov
State Government	New York State Energy Research and Development Authority	Research, Venture Capital	www.nyserda.org
Trade Association	InventNet	Support for Entrepreneurs	www.inventnet.com
Trade Association	Licensing Executives Society	Licensing	www.lesi.org
Trade Association	National Association of Home Builders (NAHB)	Economics Data on Housing Market	www.nahb.org
Trade Association	National Business Incubation	Links to Start-Up Support	www.nbia.org

Conclusion: Six Steps to Increase Your Chances of Success

To summarize, innovators in the housing industry have a substantial market opportunities. They also face challenges that most inventors face in commercializing product ideas, as well as challenges unique to the home building market. Innovators will do well to take the time to follow the course laid out in this guide:

1

Do your homework on the housing market and identify where your product fits.

2

Identify the market driver. Does it meet a building code requirement? Is it more affordable than market alternatives? Does it increase productivity or add value through increased functionality?

3

Apply for a patent or otherwise protect the intellectual property embodied in your innovation.

4

Understand regulatory implications. Does it conform to applicable building and regulatory codes? Will it need an evaluation report or change of codes in order to gain acceptance?

5

Be realistic. If you are looking to partner, understand that the manufacturer will be taking on most of the risk and funding needs, and will expect revenue that is proportionate to that commitment. If you have chosen to commercialize the invention yourself, prepare a detailed business plan and budget.

6

Seek outside support in preparing your commercialization plan. There are plenty of resources available.