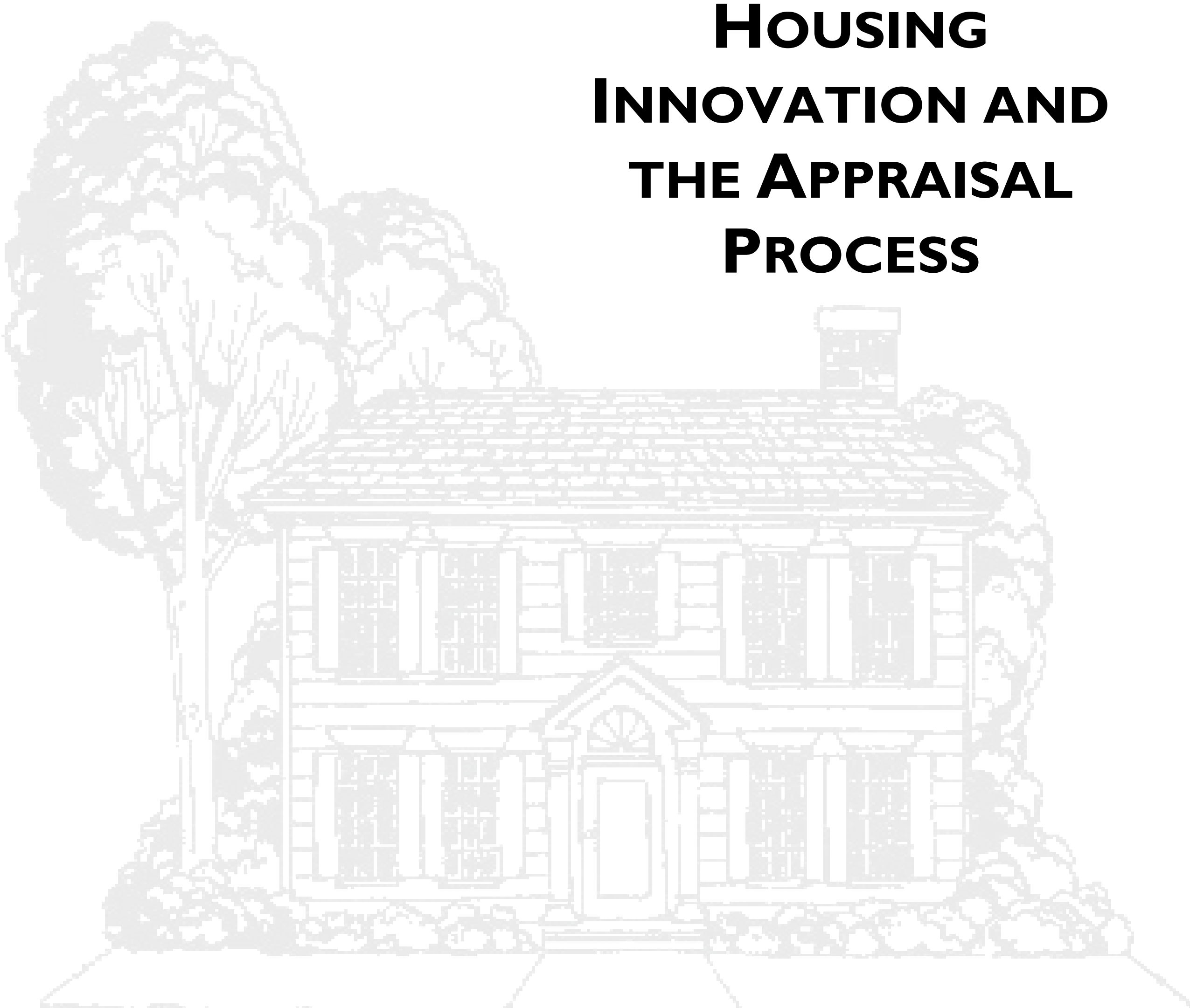
BUILDING INDUSTRY ROUNDTABLE

December 18, 2001

Bowie, Maryland

HOUSING INNOVATION AND THE APPRAISAL PROCESS



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EXECUTIVE SUMMARY

Background

In the last twenty years residential construction and mortgage financing have changed. Changes in building products and materials, as well as improvements in labor productivity, stem from the shifting tastes of homebuyers in addition to concern about housing affordability, structure quality, environmental impact due to construction, and energy efficiency.

One roadblock to the rapid adoption of technology is the valuation of technology. Newer technologies typically add to the first cost of a home. Home builders are reticent to adopt technologies that increase the cost of their product and reduce their market. Homebuyers are often unwilling to purchase technologies that are not reflected in the appraised value of the home, thus forcing the purchaser to cover the cost upfront in the down payment rather than financing the technology over the life of a mortgage. Lenders are unwilling to provide financing for structures where the value of the property is unknown in the event of foreclosure.

Valuation of innovation in residential buildings depends on the appraiser's perspective. Moreover, the attitude and role of other actors with a stake in new technologies can also influence the appraisal process.

In order to understand the roles and perspectives of the key players in the home valuation process, a Roundtable discussion was held in Bowie, Maryland on December 18, 2001. Participants included representatives from the home building and development, appraisal, real estate, lending, energy, and research sectors. Participants were asked to give a perspective statement on the valuation of residential housing technology based on their industry. Additional questions were asked about property valuation, information sources, roadblocks to innovation, and areas for potential improvement for technology adoption.

The roles of such key players, their respective issues, and perspectives follows.

Appraisers

Appraisers are in the middle of the appraisal process between the lender and the homeowner. Client pressure often exists between the loan officer and appraiser, but too much control from the lender is not good. Key statements from the discussion are:

- Appraisers' valuations reflect the market's actions. Do consumers really want energy efficient homes?
- How do appraisers become informed about a market in which the buyer recognizes new technology?
- What are the information needs? The appraisers look at comparable data. If they do not have comparable data on new technologies, they are not educated.
- How do they find data on new technologies? They may know the cost of new technology but not the market return.
- Transferability of information is an issue in addition to availability. Once data about new technologies are created, how are they transferred to appraisers?

- Can appraisers assimilate data from other geographic areas and localize it?
- Appraisers traditionally hold on to data. Similar to financial institutions, appraisers often restrict the use of their data. They no longer have a lock on data, though, as the databases of multiple listing services and court houses become more comprehensive.
- Many new technologies are invisible to the appraiser. Therefore, appraisers require not only data, but must also understand the building process. Ideally, every appraiser should spend one year with builders.
- The average appraiser will not have the time to be brought into the front-end of the construction process and go through each increment of the property to eke out the most value.
- A liability issue arises for the appraiser in establishing value for a new technology.
- Master appraisals of large subdivisions are performed by more qualified appraisers for bigger fees spread over many homes. In this process, home energy ratings economically done on a mass basis are helpful in establishing the present value of energy savings over the life of the technology.

Lenders

Lenders claim that new technology is not on a front burner, but is a customer-driven issue:

- The main incentive for the lender is a lower default rate; people who want new technology are not likely to default.
- By the time mortgages get to lenders, technology is not an issue. Loans go from loan officers to the underwriters, who package loans for the secondary market following their guidelines. Underwriters are not responsible for recognizing the value of individual building components.
- Lenders do not see that a lot of innovation will make much difference.
- Factors other than new technology, such as location, will determine whether the loan will be made.
- Since the builder sets the price with the buyer, valuation of collateral, not technology, is an issue by the time the appraisal gets to the lender.
- The ability of individuals to pay mortgages and the types of loans they want are prime considerations in making loans.
- Banks are regulated by different agencies. They have policies, for example, on loan-value ratios. The agencies provide guidelines rather than strict rules, but banks must comply with regulations overall.
- Fannie Mae Energy Efficient Mortgages (EEMs) have not been a success; only few hundred loans have been made.
- In EEMs, Fannie Mae uses energy raters (ERs) to assess energy efficiency. Fannie Mae allows an increase in value over a comparable, based on a positive difference between

the ER assessment and the model energy code for the area, taking the present value over 20 years and adding it to the appraised value.

- Since energy raters are not prevalent, they can cost between $200 and $300 and buyers are reluctant to use them.
- Mortgage technology is increasingly automated; lenders are wholesalers and want commodity loans. Under such circumstances they can process 10 to 20 loans in the time it takes to process one EEM. An Energy Star mortgage package may help speed the process.

Builders

Builders' main motivation is to sell more homes with an additional agenda of obtaining more appraised value for their homes:

- Builders who market their own buildings must think how they can utilize their marketing skills to facilitate the transfer of appropriate information on new technology to the customer and obtain their feedback.
- From a builder's point of view, new building codes have so standardized new technology relating to energy efficiency, that such new technologies are ubiquitous and do not require valuation.
- It is claimed that certain homes, particularly custom homes, are appraised for less than what these homes cost to build.
- The custom home market can afford innovations; it is with entry-level homes that changes must occur.
- The motivations of custom builders differ from large scale national builders.
- The real action is with the large scale builders. Small builders will pay attention to what they do. Large builders can connect with a Fannie Mae lender to obtain a master appraisal that considers energy efficiency and technology related to durability. From such large scale programs marketability can be determined.
- There is a need to categorize and rank innovations differently, according to whether they are continuous structural innovations the homebuyer cannot change or discontinuous innovations subject to changing tastes of buyers.
- Realtors can play a key role in promoting new technology for those builders selling through a realtor, but realtors are often disconnected from manufacturers and technologies they incorporate in their products.
- Manufacturers need to provide builders with better, more comprehensive technical information on their innovative products.
- Some builders integrate new technology into new construction and key it within their price parameters.

Homebuyers

Homebuyers may assign a higher priority to structure and appearance than new technology:

- A key issue is, what is the homebuyer willing to pay for new technology?
- Consumers need to recognize new technology's reduced operating costs over the life of the building, but their occupancy is usually of a shorter term and they have no interest in the long term.
- Education of consumers on the benefits of new technology will be a major challenge.

Suggestions for Improving Recognition and Valuation of Innovative Technologies in Housing

The following represents participants' varied ideas for improving the way new technologies are accounted for during the appraisal process.

- An independent entity could establish a point system for appraiser use that helps appraisers value new technologies by comparing them with base scores for accepted practice.
- Enhance information sharing and education on new technologies by establishing a coalition among manufacturers, appraisers, and lenders that captures and disseminates information on new technologies. Jointly sponsor education programs among appraisers, home builders, and lenders, including one-day seminars as well as three- to four-day conferences. Provide distance learning through discs and tapes.
- Inventory and assess compatibility of existing data on valuation and new technologies across agencies. The coalition's effort could be integrated with expansion of the Appraisal Institute Residential Database, Energy-Star Program Information, and an existing database of new technologies available on the NAHB Research Center's ToolBase website.
- Review and assess ToolBase information and develop targeted information for appraisers. Relax appraiser confidentiality rules on valuation data, make such information real time, and expand the existing ToolBase database to include such appraiser relevant information.
- The builders' marketing staff should be tapped to facilitate the transfer of information on new technology through their direct connection with customers. Builders should provide information on the cost/benefit of new technologies that they incorporate in buildings.
- Determine the publications that appraisers use. Publish a series of articles on the valuation of new technologies in the Appraisal Journal. Explore advisory opinions on new technology with the standards board.
- Foster a better understanding of the respective roles of builders, appraisers, and lenders as they may relate to innovation in the building process. Sponsor visits of such groups to the NAHB Research Center.

- Study the relationship between FHA default rates and new technology in Habitat for Humanity homes.
- Explore and expand the master appraisal concept.
- Make appraisals more forward looking and add a new technology section to Appraisal Form 2055.
- Manufacturers should provide not only performance specifications, but also third party data useful to appraisals.
- In the short term, develop a list of new technologies that establishes for appraisers what is currently considered innovative in a house.
- Disseminate the results of demonstrations and case studies of real projects incorporating new technologies. Revisit PATH demonstrations on the ToolBase website.

INTRODUCTION

The housing industry has experienced remarkable change in terms of how homes are built, the materials incorporated into residential structures, and how these structures are financed or purchased. Subtle technology changes that reduce the cost of construction are generally readily adopted. For example, the switch from plywood to oriented strandboard (OSB) has occurred rapidly since its inception in 1982. OSB production exceeded that of plywood production for in first time in 2000 (Structural Board Association, 2000). For technologies radically different from conventional practice, or those that increase the first cost of a home, adoption has been more difficult.

One of the perceived obstacles to technology adoption is the real estate appraisal process. Technologies that increase the first cost of a home, but provide benefits such as increased comfort, durability, energy efficiency, etc., may not be reflected in the appraised value of a home resulting in insufficient loan value for the purchase of that home. The prospective homebuyer is left to either subsidize the technology through a higher down payment or choose lower cost conventional technology.

The appraisal process is designed to assign value to real estate based on the local market. In the absence of data to demonstrate increased home value from new technology, the appraiser cannot justify increased property value based on the technology in question. In some cases, a reduced value is assigned to properties having non-conventional technology due to perceived risks involved, e.g. homeowner removing the technology in favor of conventional equipment.

The key question is how can the value of new technology be incorporated in the appraisal process, and what can justify the assigned value to new technology?

This paper will explore changes in the housing industry, the appraisal process, and identify key issues that must be addressed prior to the development of new property valuation procedures.

HOUSING INNOVATION

Innovation in housing occurs when a new technology replaces another conventional product in the performance of a particular set of processes or functions for a buyer, who may be a homebuyer, wholesaler, retailer, or any consumer in the housing production chain. New technologies are successful substitutes for conventional building products if they offer value to the homebuyer by providing:

- Functionality, i.e., enhancing or adding function such as appearance, or energy efficiency;
- Productivity, i.e., reducing the costs of inputs such as labor, materials equipment, as they relate to the final output, the house or a housing component; and/or
- Systemic Efficiency, i.e., reducing the cycle time of construction.

The Impact of Housing Industry Changes on New Technology

Trends within the housing industry are changing some of the industry's characteristics and affecting the commercialization of new technology. These trends impact how new technology is marketed and subsequently appraised:

- A greater share of the value of housing is being created offsite as housing components are increasingly prefabricated and integrated off-site. Benefits of productivity improvements accrue mainly to manufacturers, suppliers, or builders rather than being captured in a reduced cost to the consumer.
- Builder-owners increasingly come from business backgrounds rather than from the construction trades and thereby function as packagers, general contractors, and coordinators. It is difficult for many builders to understand new technology and therefore educate or market to homebuyers or appraisers about its value for housing.
- The custom and production segments of the industry are beginning to merge as customization occurs on a production basis, i.e., mass customization. This change affects the role of custom builders, the traditional proponents of new technology, and could affect homebuyers' perception of new technology in marketing new housing.
- The greater use of subcontracting results in increasing separation of ownership and management from online production and procurement functions. The fragmentation of decision-making between owners and subcontractors can be a barrier to commercialization of new technology and ultimately make it more difficult to educate consumers and appraisers on its value in housing.

Housing Market Value and Technology

The nature of innovation in the complex housing production chain poses a dilemma in valuing technologies for appraisers, builders or the homebuyers. Although costs often determine both the rate and degree of substitution of new technologies in the market, the improvements of technologies come at a price. New technologies are often introduced at a premium to cover the costs of development. Buyers may be hesitant to pay the higher price for a new product, because the value of the increased functionality is difficult to assess, particularly in housing where new technologies are often intermediate products.

A number of issues arise in valuing new technologies:

- Many new technologies are valued by the builder in improving productivity but are invisible to both the homebuyer and the appraisers.
- It is difficult to evaluate the relative advantage of some new technologies due to their complexity and lack of visibility to appraisers.
- The low valuation of new technologies by appraisers may shape consumers recognition of the value of new technology when buying a new or existing home.
- Alternatively, appraisers low valuation of new technology may reflect their uncertainty about the degree to which consumers value such technologies in the marketplace.

- Methodologies for estimating the amount of value the consumer ascribes to new technologies when buying a house are often too complex and time consuming to encompass in the appraisal process.

Uncertainty about how much homebuyers value new technologies in the marketplace may lead to low valuation of new technology by appraisers.

Currently, evidence of market valuation of technology in residential housing is almost wholly inferred from technologies associated with energy conservation. Nine studies summarized in Table 1 provide information on the relationship between residential housing values and changes in energy costs (Nevin and Watson, 1998). All studies show higher home values associated with lower energy costs, implicitly or explicitly resulting from energy efficient technologies. Three earlier studies that are comparable conclude that home value increases by between $11 and $21 for every one-dollar reduction in annual fuel expenditures. A more recent study (Nevin, Bender, and Gazan, 1999) estimates an incremental value of $10 to around $25 for every one-dollar reduction in annual fuel bills.

Most of these studies rely on a statistical technique called hedonic price analysis. The underlying idea in the analysis of hedonic prices is that, when buying a particular model of a consumer durable good, technology, or a home, the consumer buys a package of attributes (Hausman, 1979). This type of study does not, therefore, break the price into its component parts—e.g., how much the consumer is willing to pay for high efficiency windows versus an upgraded insulation. It is of interest to determine the price the consumer is willing to pay for each attribute that influences price. Hausman, 1979 uses a qualitative choice model (conjoint analysis) to estimate the parameters of consumer choice in selecting among different models of air conditioners, but does not explicitly present the results. Conjoint analysis computes consumer utilities for individual attributes of products, offering potential to overcome many of the weaknesses of existing studies. This method's potential in this regard apparently has yet to be exploited.

Seven of the studies in Table 1 were published between 1981 and 1990. Two more recent studies, which build upon previous work, were published in 1998 and 1999. The data for all the studies were gathered during period that experienced substantial change in fuel prices and mortgage interest rates. Some of studies in Table 1 are not exactly comparable because some inferred relationships between home value and fuel type, while other more relevant studies linked home value and specific energy technologies such as high values of insulation and energy-efficient windows. Also, it is difficult to draw definitive conclusions from the results of seven of the studies because of sample size limitations, circumscribed regional or local data sets, and, most important, the lack of key regression variables affecting residential housing value. The two recent studies overcome these weaknesses, but present some other methodological problems (Dacquisto, personal communication, 1999).

Based on the evidence, appraisers need more studies that use comparable, defensible methodologies before rules of thumb can be developed that they can apply in the field in assessing the value of new technologies. Moreover, the positive results of these studies directly contradict to the negative results of studies that focus on consumer discount rates as applied to energy technologies

Table 1: Summary of Studies Relating Housing Value to Energy Use

Study	Sample Size	Time Period	Key Findings
A	269	1970-1975	The 1974 spike in relative cost of fuel oil raised price differential between gas- and oil-heated houses to $761 in 1974, and up to $4,597 in first half of 1975.
B	100	1978-1979	Value of energy-efficient homes (with lower structural heat loss) was $3,248 higher than inefficient homes.
C	81	1980	Home value increased by $2,510 for each one-point decrease in thermal integrity factor.
D	505	1971-1978	A one-inch increase in wall insulation increased home value by $1.90 per square foot; a one-inch increase in ceiling insulation increased home value by $3.37 per square foot; high quality (energy-efficient) windows increased home value by $1.63 per square foot.
E	1,317	1978	Home value increased by about $20.73 for every $1 decrease in annual fuel bills.
F	234	1982	Home value increased by $11.63 per $1 decrease in fuel expenditures needed to maintain house at 64˚F in average heating season.
G	67	1983-1985	Home value increased by about $12.52 per $1 decrease in electric bills, consistent with home buyers discounting savings after-tax mortgage interest rate.
H	16,000(US) 10,000 (MSA)	1992-1996	Incremental home value of $10 to around $25 for every $1 reduction in annual fuel bills; homeowner capitalization rate expected to be 4%-10% reflecting the range of after-tax mortgage interest rates during the 1990s.
I	25 MSAs	1993-1996	Remodeling: estimated energy value for clear glass double-pane windows replacing metal frame - $8,486; replacing wood frame - $6,272.

a. Robert Halverson and Henry O. Pollakowski, "The Effects of Fuel Prices on House Prices," *Urban Studies*, v. 18. No. 2 (1981): 205-211.

b. John B. Corbel, Paul R Goebel, and Charles E. Wade, "Measuring Energy Efficiency for Selection and Adjustment of Comparable Sales," *The Appraisal Journal* (January 1982): 71-78.

c. Joseph Laquatra, "housing Market Capitalization of Thermal Integrity," *Energy Economics* July 1986): 134-138.

d. Molly Longstreth, "impact of Consumers' Personal Characteristics on Hedonic Prices of Energy-Conserving Durable Good Investments," *Energy*, v. 11, No. 9 (1986): 893-905.

e. Ruth C. Johnson and David L. Kaserman, "Housing Market Capitalization of Energy Saving Durable Good Investments," *Economic Inquiry* (July 1983): 374-386.

f. Terry M. Dinan and John A. Miranowski, "Estimating The Implicit Price of Energy Efficiency Improvements in the Residential Housing Market: A Hedonic Approach," *Journal of Urban Economics*, v. 25, no. 1 (1989) 52-67.

g. Marvin J. Horowitz and Hassein Harei, "Economic Efficiency v. Energy Efficiency," *Energy Economics* (April 190): 122-131.

h. Rick Nevin and Gregory Watson, "Evidence of Rational Market Valuations for Home Energy Efficiency," *The Appraisal Journal*, (October 1998): 401-409.

i. Rick Nevin, Christopher Bender, and Heather Gazan, "Construction and the Appraiser: More Evidence of Rational Market Values for Home Energy Efficiency," *The Appraisal Journal*, (October 1999): 454-460.

Sources:

Rick Nevin and Gregory Watson, "Evidence of Rational Market Valuations for Home Energy Efficiency," The Appraisal Journal, (October 1998): 401-409; and

Rick Nevin, Christopher Bender, and Heather Gazan. "Construction and the Appraiser: More Evidence of Rational Market Values for Home Energy Efficiency," *The Appraisal Journal*, (October 1999): 454-460.

Discount Rates and Energy Policy

The discount rate, a more indirect analytical concept, is useful in analyzing consumer valuation of technologies in the marketplace. The household discount rate is simply the investment yield or rate of return that households seemingly require for making a capital investment (Horowitz 1990). The discount rate is important for several reasons:

- The discount rate is a crucial parameter for projecting technology investment levels or household adoption of new technologies such as those involved in energy conservation. For example, discount rates higher than prevailing interest rates in the credit market indicate reluctance on the part of the consumer to invest in new technology.
- The discount rate is an indicator of real estate market efficiency. In a perfectly competitive market where technology is produced to match buyer's preferences, homebuyers should be willing to invest in new technologies until the marginal value of the benefits equals the marginal cost of the innovation. According to financial theory, the appropriate rate of return would be the homebuyers' opportunity cost of capital. In thermal technologies if the lifetimes match that of the house (such as insulation) and the benefit is net of taxes, the appropriate opportunity interest rate may be equal to the after-tax mortgage interest rate.
- Household discount rates that are substantially higher than the prevailing interest rate (e.g., after-tax mortgage rate), indicates uncertainty due to: insufficient information for the homeowner, appraiser, or lender; limitations of homeowner income; or other imperfections in the real estate market. These imperfections could help justify some modification of behavior or intervention such as communication and education by the private sector acting alone, public and quasi-public agencies, or interested non-profit associations.
- Conversely, discount rates lower than opportunity cost might indicate that homebuyers are viewing the added expenditures on new technology as "consumers" rather than as pure investors. They might find that additional functional or non-quantifiable benefit in attributes of a technology, such as improved appearance or health, outweighs higher price.

Numerous studies have addressed discounts rates for households implied by either investment in (1) equipment or (2) thermal efficiency.

Equipment Studies

In one study of equipment and appliances, Hausman 1979 found a discount rate of about 25 percent for room air conditioners, which substantially exceeded prevailing rates assumed in typical engineering calculations used to determine life-cycle costs. Such analysis normally evaluates tradeoffs between lower operating costs through increased energy conservation against higher initial capital costs. The study concluded that energy conservation measures, as an example of new technologies, might have difficulty succeeding if consumers have such a high discount rate. According to Horowitz 1990, however, the discount rates for households implied by this equipment study are not directly comparable to investments in technologies associated with the building shell improvements because the risk levels of the investment are quite different.

Thermal Efficiency Studies

Six studies have addressed the implied discount rates for household investment in technologies associated with thermal efficiency. Johnson and Kaserman 1983 used a hedonic price model to derive an average rate of 9.14 percent, suggesting that the real estate market fully capitalized the value of the benefits of thermal efficiency in the sale price. The key variable in this hedonic model was annual fuel bill, which makes the results problematic, according to Horowitz. A host of factors such as income and number of occupants determine energy expenditures, and their decrease should not be assumed to be directly equivalent to energy efficiency.

The other studies of discount rates for thermal efficiency use a variety of statistical and financial methods and produce wide variations in discount rates as well as unaccountable variations resulting from shell technologies of similar risk and investment characteristics within the same study. Cole and Fuller 1981, Corum and Neal 1982, and Hartman and Doane 1986 find average discount rates ranging from a low of seven percent to a high of 32 percent. Train and Strebel 1986 find median discount rates ranging from 33 to 378 percent.

These studies use indirect measures of energy savings and/or cost, such as engineering calculations, simulations, statistical projections, and survey responses. The absence of observed data necessitated these measures, but they probably contained substantial measurement errors, according to Horowitz. For example, Hirst 1986 compared direct household energy savings using billing histories to audited-estimated savings and found that the audit was not a reliable predictor of energy savings. The large window for error in measurements is probably responsible for the wide variation in results.

To avoid the problems associated with studies cited above, Horowitz, in a study of thermal efficiency, based average energy savings on recorded household behavior. In this study compliance with the Model Compliance Code (MCS) in Tacoma, Washington could be achieved by installing pre-specified levels of insulation in certain building elements, or a pre-specified glass-to-wall area, or a combination of individual envelope and equipment choices. The study determined the household discount rate for a MCS feature implied by purchases of almost new, electrically heated single-family houses was approximately eight percent. In adopting a relatively simple yield calculation ordinarily used to compute the return on an annuity, the study made some simplifying assumptions: lifetime of investment is the same as the lifetime of the structure; the investment is risk-free in the sense that there is no physical deterioration, maintenance, or replacement costs; net energy savings per year are constant; and, energy prices remain constant in real terms over the life of the investment.

The study had some other limitations. The study focused on point estimates of the average price and benefit of the MCS feature rather estimating implicit prices and savings for individual households. Consequently, no insights can be offered regarding the variation in household discount rates and income levels, education, and other socio-economic variables.

Implications

Most technologies show that a definite and substantial tradeoff exists between initial purchase price and operating costs. For example, Hausman, 1979 demonstrated in a study of HVAC technology that lower operating costs were only achieved at a higher price. Consumer choice of a particular model or technology, however, depends not only on this tradeoff but also on personal characteristics, tastes, intended utilization, and price of electricity in the particular area. He concluded that the significant disparity between the individual discount rate and the social discount rate or prevailing interest rates of funds available in credit markets used in benefit cost calculations, might be narrowed by a number of alternate policies that lead to purchases of more energy efficient equipment. The following policy options are based on those proposed by Hausman, but have been expanded to be applicable to a broader range of technologies than those related only to energy:

- Tax subsidies could lower the initial capital cost and make the tradeoff toward lower operating cost more favorable
- Utility companies or private companies could lease more efficient appliances or new technologies to customers with the option to buy, allowing them to make a trial and experience the presumable favorable effects of such technologies, that could eventually lead to increased demand.
- Government or non-profit associations could undertake an educational program to help consumers, appraisers, and lenders better understand the tradeoff between initial purchase price and future lower operating costs as well as other benefits of new technologies. Individuals take this price tradeoff into account to some extent. Better information might lead to a more informed choice.
- Government could set efficiency standards that mandate new technologies, which would eliminate consumer price tradeoffs, increase adoption, and accomplish the requisite benefits. Such standards, however, would need to be quite complex, requiring much administrative effort, generating a number of economic or bureaucratic problems.
- Upper income groups have an implied discount rate much closer to the prevailing interest rate in credit markets, while the discount rate of the poor is much higher due to the uncertainty of their incomes streams and their lack of savings. Setting efficiency standards would result in increased purchase price of more efficient technologies and therefore would be more onerous to the low income households that often need such technologies the most and that tend to pay a larger portion of their income on energy bills.

If the cost of program administration and management, the co-called "transaction costs" are added to the engineering analysis or benefit-cost calculation, some of these policy options might prove to be financially infeasible (Standard and Howarth 1994). This may be especially true in the case of educational programs and development and enforcement of mandatory standards, where large staffs would be required to develop, implement, and oversee programs.

THE APPRAISAL PROCESS

Appraisal Methodology

Prior to the sale of real property - land and anything attached to it - an appraisal may be required by the lending organization to assure that the value of its collateral, the real property, is within the parameters required based on the requested loan amount. Appraisals are derived using one of three common approaches. They are:

- Cost Approach - the estimated cost to replace or reproduce the land improvements at the time of the appraisal. This cost is added to the land value after physical deterioration, functional obsolescence, and economic obsolescence is subtracted.

- Comparison Approach - the estimated value of land and improvements based upon the value (sale price) of other properties of similar size, quality and location recently transacted.
- Income Approach - the estimate of what a knowledgeable investor would pay for a property based upon the net income generation of that property. This approach is not used often for estimating residential property values.

The lender generally contracts the services of a third-party appraiser for the determination of property value. The prospective homebuyer usually pays the cost of the appraisal service.

Appraiser Qualifications

In the aftermath of the savings and loan scandal in the late 1980's, Congress enacted the Financial Institutions Reform, Recovery, and Enforcement Act (FIRREA) of 1989. Title XI of FIRREA, the "Real Estate Appraisal Reform Amendments," was created to solve appraisal-related problems associated with the crisis. Title XI stipulates the qualifications and standards required by appraisers through a network of federal, state, and private sector partners.

Title XI charges The Appraisal Foundation, a private, not-for-profit corporation, for oversight of appraisal standards and qualifications. The Appraisal Foundation established the Appraiser Qualifications Board (AQB) and the Appraisal Standards Board (ASB) to promulgate and maintain the Appraiser Qualifications Criteria (ACQ) and the Uniform Standards of Professional Appraisal Practice (USPAP) respectfully. The ACQ is the minimum criteria for state certification or licensing of appraisers. USPAP is the formal rule of procedure for developing an appraisal and reporting its results.

Appraiser Qualifications Criteria

The AQB lists several categories of appraisers in its publication, *The Real Property Appraiser Qualification Criteria and Interpretations of the Criteria* published October 1, 1999. The four appraiser classifications include:

- Trainee Real Property Appraiser - can appraise properties that the supervisor is permitted to appraise.
- Licensed Real Property Appraiser - can appraise non-complex one to four unit residential properties with a transaction value less than $1,000,000 or complex one to four unit properties with a transaction value less than $250,000.
- Certified Residential Real Property Appraiser - can appraise one to four unit residential properties without regard to value or complexity.
- Certified General Real Property Appraiser - can appraise all types of real property.

This classification list is ranked in increasing responsibility or ability. Each classification has requirements for education, work experience, and examinations or tests. Table 2 summarizes the requirements for each appraiser classification. In each case, it is the state that licenses or certifies the appraiser.

In addition to conforming to USPAP, individual states may have further requirements placed upon licensed or certified appraisers. The state regulatory agency is responsible for promulgating and maintaining the additional requirements placed upon appraisers working in their region.

Table 2. Appraiser Qualification Criteria

Classification	Education (classroom hours)	Continuing Education (classroom hours)	Work Experience	Examination
Trainee Real Property Appraiser	75	14 per year	None	None
Licensed Real Property Appraiser	90	14 per year	2,000 hours	AQB endorsed Uniform State Licensed Real Property Appraiser Examination
Certified Residential Real Property Appraiser	120	14 per year	2,500 hours	AQB endorsed Uniform State Certified Residential Real Property Appraiser Examination
Certified General Real Property Appraiser	180	14 per year	3,000	AQB endorsed Uniform State Certified General Real Property Appraiser Examination

Appraisal Regulatory Structure

The regulatory structure of the appraisal process is a complicated web of federal, state, and private organizations. Title XI of FIRREA established the network centered on the Appraisal Subcommittee (ASC) of the Federal Financial Institutions Examination Council. The ASC consists of representatives from the Federal Reserve Board, the Office of the Comptroller of the Currency, the Office of Thrift Supervision, the Federal Deposit Insurance Corporation, the National Credit Union Administration, and the Department of Housing and Urban Development. The ASC is charged with monitoring and ensuring each state and territory certification and licensing program and policies are compliant with Title XI.

Congress charges The Appraisal Foundation with the promulgation and maintenance of USPAP and the qualification criteria required by licensed and certified appraisers. Based on the USPAP and AQC, each state or territory is charged with the regulation and oversight of appraisal certification and licensing in its territory. The states charge a fee, which supports the activities of the ASC and Title XI duties of The Appraisal Foundation.

Title XI requires that the Federal Reserve Board, the Office of the Comptroller of the Currency, the Office of Thrift Supervision, the Federal Deposit Insurance Corporation, the National Credit Union Administration, and the Department of Housing and Urban Development adopt regulations regarding federally related transactions involving real estate appraisal. These regulations address when appraisals are required, who performs them, and how they are conducted.

Appraiser Education

In order to be minimally certified or licensed, an appraiser must conform to the educational requirements stipulated by The Appraiser Qualification Criteria described in Table 1. Coursework can be conducted using a variety of institutions including:

- Colleges or universities
- Community or junior colleges
- Real estate appraisal organizations such as The Appraisal Institute or the National Association of Independent Fee Appraisers
- Real estate related organizations such as the National Association of Realtors
- State or federal agencies/commissions
- Proprietary schools
- Other providers approved by state certification/licensing agencies.

The AQC has further requirements concerning the type of coursework required for each appraiser classification. These relate to the topical nature of the courses such as economic principals, appraisal statistical concepts, legal considerations, etc. Individual state or territory appraisal certification and licensing agencies may require additional coursework.

FINANCING NEW TECHNOLOGY

In both new and existing homes, it makes sense to use mortgage financing to pay for the cost of new technologies because loan terms are long in duration, interest rates are the lowest available, and interest is tax deductible. The cost of new technologies investments, however, can negatively affect the lender's qualifying ratios for a new home mortgage, even if the technology eventually pays for itself by reducing the homeowner's operating cost or offering other tangible benefits.

New technologies, by increasing total housing cost, can negatively affect the lenders' housing cost-to-income ratio (or front-end ratio), debt-to income ratio (or back-end ratio), and loan-to-value ratio. Monthly housing expenses include principal, interest, taxes, and income (PITI), which lenders limit to no more than 28 percent of monthly income. Lenders also limit the total personal monthly obligations to 36 percent of monthly income. The sales price or appraised value (whichever is lower) as a share of the total loan or mortgage constitutes the loan-to-value ratio, which can range from 80 to 95 percent. The cost of new technologies can increase the homebuyer's total monthly PITI or mortgage loan so that they exceed these qualifying ratios.

Fannie Mae and Freddie Mac

The only experience with using mortgages to facilitate the adoption of new technologies has been in the area of energy conservation. The Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac) have established energy-efficient mortgages (EEMs) that allow for a two- percent "stretch" over normal qualifying ratios. The EEM therefore raises the housing cost-to-income ratio to 30 percent and the debt-to-income ratio to 38 percent to help buyers wishing to purchase an approved list of more expensive energy conservation technologies, but the stretch has little effect on the loan-to-value ratio.

If the amount for the energy conservation technologies is included in the purchase price of the home, the resulting increase in purchase price requires a higher but still relatively low down payment to maintain the same loan-to-value ratio. The increase in the down payment, however, is much more if the appraiser does not attribute any additional value to the home as a result of the energy efficiency technologies. In such a case, the sales price of the new home remains as is and does not reflect such improvements. The entire cost of the energy technologies therefore must be added to the down payment to maintain the same loan-to-value ratio.

FHA

The Federal Housing Administration (FHA) offers an EEM that permits the cost of energy-efficient measures to be added directly to the mortgage, as long as additional costs does not exceed the greater of $4,000 or five percent of the property's value (not to exceed $8,000). This allows someone who ordinarily would qualify for a loan without such improvements to qualify for a FHA EEM without any increase in down payment. The FHA defines a cost-effective energy efficient investment as one that is less than the present value of the energy saved over the useful life of the investment. The EEM, however, is subject to relatively low FHA maximum single-family mortgage limits.

Pilot Program

Fannie Mae and Freddie Mac have a pilot program that allows the incremental cost of energy–efficient, cost-effective upgrades to be added to the appraised value of a home. The homebuyer must only provide the additional down payment related to the increased appraised value in order to maintain the same loan-to-value ratio. Energy Rated Homes of Vermont (ERH-VT) used Freddie Mac's and Fannie Mae's "Energy Appraisal Addendum" Form 70B/1004C to allow appraisers to adjust appraisals by the cost of installed energy improvements in existing homes. Thus homebuyers could minimize or possibly eliminate any additional down payment needed for the improvements. Increased down payments have traditionally been a stumbling block for EEMs, according to ERH-VT.

Implications of Mortgage Products for New Technologies

Although special mortgage programs modeled after EEMs facilitate the adoption of new technologies, it is unlikely that EEMs could be exactly imitated. Cost-effectiveness, the principal criterion in developing a mortgage product is not easily measured in many new technologies. For many new technologies, improved functionality rather than cost is the principal criterion for adoption. Moreover, one of the main drivers for mortgage programs such as EEMs is that they provide beneficial "external" effects to the nation or public at large that cannot be achieved from conventional technologies or the status quo. Special mortgage programs originating from the private sector or public agencies are therefore best suited to technologies that have some public purpose. However, as noted before, the benefits of many new technologies accrue primarily to manufacturers, builders, or intermediate suppliers in the private sector before they are sold and indirectly only benefit the consumer.

The EEM has not been very successful. In 1999 less than 0.1 percent of the total residential market of 13 million loans included an energy efficient component (Farhar, 2000). In contrast to new home mortgages, Energy Improvement Mortgages (EIMs) are mortgages specifically aimed at energy efficiency measures in existing homes. The experience of EIMs financing energy improvements in existing homes provides clues for the lack of success of EEMs (Faesey, 2000). EIMs rely on the down payment and interest rate advantages resulting from including the loan as part of a mortgage rather than the stretch in the debt-income ratio, a feature of EEMs. EIMs offer valuable lessons relating to institutional barriers, if energy mortgages or similar mortgage products are to be considered for speeding the adoption new technologies (Faesey, 2000):

- Lenders and real estate agents - According to Energy Rated Homes of Vermont, more than 90 percent are not interested in EIMs for the following reasons:
  - ✓ Afraid to use EIMs because it is new, appears too complicated, and adds risk,
  - ✓ Not interested in doing anything that will lengthen the time to closing or obtaining commission,
  - ✓ Fear of additional troubles with escrow accounts and follow-up after closing, and
  - ✓ Expect the energy rating and bid process for improvements can delay closing a couple of weeks
- Competent energy raters and project managers or facilitators - Persons knowledgeable in building science, diagnostics, and personal communication are key not only to identifying energy saving opportunities, but opportunities for new technologies as well:
  - ✓ In existing buildings, competent persons can identify savings opportunities, foresee and solve problems, and keep all interested parties apprized of job progress, and
  - ✓ Such persons must have a thorough understanding of the mortgage process generally, including terms, time frames, mortgage products, and the Mortgage Program specifically.
- Homebuyers - Qualified personnel should manage improvements made under the EIM, not the homebuyer.
  - ✓ Buyers who are not involved in an EIM from beginning to end can generate problems, and
  - ✓ Low estimates or guesses of technology-installed cost can result in work delays and lower lender confidence.
- Mortgage Products - Initially, energy mortgages were unworkable:
  - ✓ EIMs did nothing to adjust the appraised value of improved properties and thus required buyers to increase the down payment, and
  - ✓ They required buyers to qualify for the larger mortgage amount despite the promise of future energy savings. However, some innovative products discussed in the previous section attempt to overcome these shortfalls.

APPRAISER'S ROLE IN VALUATION OF NEW TECHNOLOGY

Given the variability in the methods and results of existing studies that relate to energy efficient technologies to housing value, how is the appraiser to evaluate and attribute value to energy technologies? Another related and more relevant question is how is such a valuation to be achieved in other new technologies where the benefits and costs may not be as easily measured as those related to energy technologies?

In regard to energy technology, appraisers are subject to a variety of opposing requirements and demands from key participants in the housing market (Ragas and Wyatt, 1978).

- Homebuyers and residents want lower energy costs, but what price does the market attribute to energy efficient technology and construction standards?
- Builders are constantly modifying construction practices to meet new energy-related building codes, but are not sure of the possible additional value that largely invisible improvements such as energy efficient walls should command in the conventional appraisal analysis.
- Ideally lenders would desire more predictability in their customers' utility bills, but have not been able to relate the appraisal process to their requirements.

The same questions could apply to the valuation of a broader range of new technologies. The direct sales comparison and replacement cost approach in appraisals have worked well in the residential market when cost information is available on a large market of comparable homes. Rapid diffusion of new technologies or significant shifts in consumer tastes and quality standards, however, decrease the availability of comparable sales. Appraisers need a method to transform future savings of energy and other technologies into an estimate of current value.

A number of methods have been proposed for valuation of energy technologies based on a capitalization technique (Ragas and Wyatt, 1978). Capitalization is the process through which future income is converted to present value (Laquatra, 1986). In the housing market, capitalization is expressed in the homebuyer's desire to trade higher capital costs in the present for lower operating costs in the future. In the consumer's investment decision the valuation of future benefits and costs is a function of the discount rate. In this method an estimate of future savings in utility bills is combined with a capitalization or discount rate that considers "the cost of equity funds, typical consumer holding periods, principal recapture and inflation expectations" (Ragas and Wyatt, 1978).

The capitalization technique is relatively complex and problematic. Given the variability of the studies of the discount rate related to energy conservation investments, the reliability and practicality of the method remains in question. Moreover, it is not easily quantified in the office or the field. According to one expert, "most authors have focused on the specification of some technique for quantifying the "price effects" of differential levels of energy efficiency. Although such articles have generated interesting ideas and mathematical formulae, they have failed to present either a theoretical unified application that appraisers can adopt. The proposed treatments range from outright avoidance to finite dollar adjustments for various levels of efficiency. Since the issue of "energy Efficiency" has already triggered a plethora of reactive, pragmatic research, perhaps the first question to be asked should be whether or not the attribute should be considered at all" (DeLisle, 1984).

The ability of appraisers to recognize and evaluate existing or innovative technologies poses a number of problems, aside from issues relating to methodology. In the case of energy technology, one approach is to assign value to energy efficiency based on manufacturers' labels regarding thermal performance of appliances or HVAC equipment. One authority disclaims reliance on a manufacturer's labels or nameplates in determining the efficiency of a furnace, because labels are unreliable (Isaacson, 1981). Instead, it is suggested that appraisers will find data obtained from thermography and temperature probing useful in assessing the energy efficiency of a technology and hence its future value. If the appraiser understands energy audit data and knows how to incorporate it into three approaches to assessing value, appraisals will be more accurate. As noted above, however, audited energy savings do not necessarily reflect actual savings (Hirst, 1986).

Appraisers are apparently already reluctant to become involved in the evaluation of existing technologies in the course of their appraisals. Given such opposition it could hardly be expected that they would be motivated assess the value of new technologies.

The 4150.2 FHA requirements for appraisers went into effect in September 1999, requiring appraisers to complete a Comprehensive Valuation Package, which included an evaluation of a number of construction components in the home. A sample of the reaction is as follows: "HUD is making us out to be home inspectors, and I am not going to increase my liability and fill out these forms. What do I know about environmental or structural deficiencies? I am just going to call for a home inspection on every appraisal I receive" (Hopkins 2000).

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