From: Renee Cahoon <Renee.Cahoon@sonoma-county.org>
Sent: Friday, March 23, 2012 2:32 PM
To: !FHFA REG-COMMENTS
Subject: RIN 2590-AA53
Attachments: Comment Letter W EXHS.pdf

Attention: Comments/RIN 2590-AA53

We are writing to express our comments on FHFA's Advance Notice of Proposed Rulemaking addressing whether and under what condition the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation may purchase mortgages for properties participating in Property Assessed Clean Energy ("PACE") programs.

The County of Sonoma and all cities in the County resolved to reduce greenhouse gas emissions to 20% below 1990 levels by 2015. County board members and City Council members saw PACE as a powerful tool to help reach this goal. After studying the feasibility of launching a program, meeting with stakeholders such as local banks and contractors, and following a noticed public hearing, the County launched the Sonoma County Energy Independence Program (SCEIP) in March, 2009. By June of 2010, SCEIP was funding approximately 116 efficiency and renewable energy projects, valued at $2.5 million, each month. This rate of participation not only benefitted the environment, but also assisted our local construction by creating new green retrofitting jobs to replace jobs lost in the housing crash.

The success of the County's Program is noteworthy, even though its momentum was considerably slowed by the actions of FHFA, Fannie Mae, and Freddie Mac. Over 1600 property owners have participated in the Program, completing over 1000 solar installations and 1600 energy efficiency projects. Solar installations have generated 7.7 megawatts of energy production, resulting in the removal of 4682 tons of CO2 from the atmosphere. This is the equivalent of removing over 800 cars from the road.

The County is providing additional information on its Program, and legal and factual responses to the questions posed by FHFA. Because our comment letter exceeds 2000 characters, we are attaching it to this web form.

Thank you for your attention to this critically important matter.

Shirlee Zane
Chairwoman, Sonoma County Board of Supervisors

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March 23, 2012

[Sent via Federal eRulemaking Portal: http://www.regulations.gov and Email to FHFA at RegComments@fhfa.gov]

Mr. Alfred M. Pollard
General Counsel
Attn: Comments/RIN 2590-AA53
Federal Housing Finance Agency
400 Seventh Street SW, Eighth Floor
Washington, DC 20024

Attention: Comments/RIN 2590-AA53

Dear Mr. Pollard:

We are writing to express our comments on the Advance Notice of Proposed Rulemaking (ANPR) published by the Federal Housing Finance Agency ("FHFA" or "Agency") on January 26, 2012,[1] addressing whether and under what condition the Federal National Mortgage Association ("Fannie Mae") and the Federal Home Loan Mortgage Corporation ("Freddie Mac") (collectively, the "Enterprises") may purchase mortgages for properties participating in Property Assessed Clean Energy ("PACE") programs. PACE programs had their genesis in California and Babylon, New York, beginning in 2008, as a solution to overcome the stumbling block of financing the up-front cost of energy efficiency and renewable energy projects in both residential and commercial properties.

The California Legislature pioneered PACE legislation when it adopted California Assembly Bill 811 (Cal. Stats. 2008, ch. 159), amending Chapter 29 of the California Streets and Highways Code, entitled Contractual Assessments. The Legislature found that establishing contractual assessment programs to fund energy efficiency and renewable energy improvements would serve the critical public purpose of addressing global climate change:

- Energy conservation efforts, including the promotion of energy efficiency improvements to residential, commercial, industrial, or other real property are necessary to address the issue of global climate change.
- The upfront cost of making residential, commercial, industrial, or other real property more energy efficient prevents many property owners from making those improvements.

[1] 77 Fed. Reg. 3958 (Jan. 26, 2012).

- To make those improvements more affordable and to promote the installation of those improvements, it is necessary to authorize an alternative procedure for authorizing assessments to finance the cost of energy efficiency improvements.
- [A] public purpose will be served by a contractual assessment program that provides the legislative body of any city with the authority to finance the installation of distributed generation renewable energy sources and energy efficiency improvements that are permanently fixed to residential, commercial, industrial, or other real property.

  Cal. Streets & Hwys. Code § 5898.14.

The County of Sonoma and all of the nine incorporated cities in the County had resolved to reduce greenhouse gas emissions to 20 percent below 1990 levels by the year 2015. The Board of Supervisors and City Council members saw AB 811 as a powerful tool to help reach this goal. After studying the feasibility of launching a program, and investing significant staff time in meeting with stakeholders such as local banks and contractors, and following a noticed public hearing, the County launched its Energy Independence Program in March, 2009. The launch of the program was met with enthusiasm on all fronts. At the time, as a result of the real estate market implosion caused by poor lending and regulatory practices, banks refused to lend anything to either residential or commercial property owners. The County's program, known as SCEIP (Sonoma County Energy Independence Program) filled this void. The County established reasonable criteria for participation in the Program (set out in detail, *infra*) and worked to promote participation in the Program. By June of 2010, SCEIP was funding approximately 116 efficiency and renewable energy projects, valued at $2.5 million, each month. This rate of participation not only benefitted the environment, but also assisted our local construction industry, which had been devastated by the collapse of the housing market, to adapt to the economic climate and mitigate job losses by the creation of new green retrofitting jobs made possible by Program funding.

The success of the County's Program is noteworthy, even though its momentum was considerably slowed by the FHFA Statement and actions by Fannie Mae and Freddie Mac. Over 1600 property owners have participated in the Program, completing over 1000 solar installations and 1600 energy efficiency projects. Solar installations have generated 7.7 megawatts of energy production, resulting in the removal of 4682 tons of carbon dioxide from the atmosphere. This is the equivalent of having removed over 800 cars from the road.

The concept of PACE was named one of the top 20 ideas that could change the world by Scientific American magazine and one of the top 10 breakthrough ideas for 2010 in the Harvard Business Review. Twenty-seven state Legislatures authorized the establishment of PACE programs by local jurisdictions. The White House embraced the concept of PACE, making it the financial centerpiece of the "Recovery Through Retrofit" program.[2] The White House indicated its intention to "work in partnership" with state and local governments to standardize best practices for PACE programs, and released a "Policy Framework for PACE Financing Programs," announcing support "for the use of federal funds for pilot programs of PACE

[2] http://www.whitehouse.gov/assets/documents/Recovery_Through_Retrofit_Final_Report.pdf, p. 8.

financing."[3] The Department of Energy, through the American Recovery and Reinvestment Act's Energy Efficiency Conservation Block Grant Program identified PACE as eligible for receipt of federal stimulus funds to initiate new programs.

Before such support could be implemented, however, FHFA acted deliberately and definitively to shut down existing PACE programs and thwart the initiation of any new programs. On July 6, 2010, the Agency issued its "Statement on Certain Energy Retrofit Loan Programs" stating its intent to "pause" PACE programs.[4] In the Statement, FHFA makes numerous unsupported statements about the "risk" associated with PACE programs. Although PACE assessments are indistinguishable from other local assessments established for other public purposes, FHFA contends that: "First liens established by PACE loans are unlike routine tax assessments and pose unusual and difficult risk management challenges for lenders, servicers and mortgage securities investors"; PACE programs "present significant risk to lenders and secondary market entities, may alter valuations for mortgage-backed securities and are not essential for successful programs to spur energy conservation" and "disrupt a fragile housing finance market and long-standing lending priorities." Further, FHFA asserted: "the absence of robust underwriting standards to protect homeowners and the lack of energy retrofit standards to assist homeowners, appraisers, inspectors and lenders determine the value of retrofit products combine to raise safety and soundness concerns." As a direct result of FHFA's actions, the Department of Energy withdrew its support for PACE programs, thus undermining the establishment of programs that would have greatly benefitted the environment by removing untold tons of greenhouse gases from the atmosphere. FHFA contended it had no obligation to consider the consequences of its actions outside of the narrow focus of the hypothetical potential of risk to the Enterprises. Not only is FHFA wrong in its evaluation of risk to the Enterprises, but the Agency ignored its broader duty to consider the public interest in establishing regulations, which certainly should include the effects of its actions on the environment, and the effects of its actions on employment (for example, the Agency's action was to the great detriment of the construction industry in Sonoma County, causing loss of jobs and possibly loss of homes by construction workers that lost their jobs, who had hoped SCEIP would see them through to the other side of the housing crisis.)

FHFA's objection to PACE programs begins with the assumption that PACE assessments are different than "traditional" assessments. This assumption is incorrect. In establishing PACE programs, the State Legislature, and then the local government entity, have made findings that establishment of a program to install energy efficiency and renewable energy improvements ("the project") serves an essential public purpose. Public funds are extended to complete the project. The project not only serves the public purposes enumerated above, but also specifically benefits the property that is the subject of the assessment, by reducing utility costs for the property, and increasing the value of the property.[5]

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[3] http://www.whitehouse.gov/assets/documents/PACE_Principles.pdf.
[4] http://www.fhfa.gov/webfiles/15884/PACESTMT7610.pdf.
[5] Numerous studies support the point that energy efficiency and renewable improvements increase the value of residential property. See, for example:
B. Bloom, M. C. Nobe, & M. D. Nobe. "Valuing Green Home Designs: A Study of ENERGY STAR Homes." *Journal of Sustainable Real Estate*. 3:1. 109-126. 2011.
http://www.costar.com/uploadedFiles/JOSRE/JournalPdfs/06.109_126.pdf.

That is the essence of an assessment: public credit has been extended to complete a project, for a public purpose, that benefits particular property. Courts, including the United States Supreme Court, have recognized this power of local government for over a century. *See, e.g., Hagar v. Reclamation District No. 108*, 111 U.S. 701, 704 (1884): "It is not open to doubt that it is in the power of the State to require local improvements to be made which are essential to the health and prosperity of any community within its borders." (providing for the construction of canals and levees, to be paid for by assessments on benefitted property.) *See also Isaac v. City of Los Angeles*, 66 Cal.App.4th 586, 596 (1998): "[A] special assessment is . . a benefit to specific property that is financed through the public credit."

Assessments are established for numerous types of public projects. These include building and maintaining roads, street lighting, and landscaping; building and maintaining water delivery and sewer systems; and addressing seismic and geologic hazards. Necessarily, some of these projects require public ownership of the improvement, and require the participation of a neighborhood block to accomplish the purpose. Assessments related to sewer and road projects would be examples. Other public projects, such as energy and seismic upgrades, necessarily involve work on individual properties, and can be accomplished by work on non-contiguous properties. The essence of the project remains the same: a project to accomplish a public purpose, funded with public funds, and benefitting private property. That is a traditional assessment.

FHFA contends that PACE assessments are different because a property owner voluntarily joins the program and agrees to install the energy improvements. This is no different from many existing assessment statutes. Generally, initiation of assessment proceedings requires a petition by some percentage of affected property owners. (*See* Special or Local Assessments, 70C Am.Jur.2d § 119, p. 733 (2000)). Federal courts have upheld assessment liens as having priority against prior-in-time mortgage holders even where assessment proceedings were initiated upon the request of a single landowner/ developer. *See, e.g., Zipperer v. City of Fort Myers,* 41 F.3d 619, 625 (11th Cir. 1995); *Federal Deposit Insurance Corporation v. City of New Iberia,* 921 F.2d 610, 616 (5th Cir. 1991). There is no legal difference between those assessments and the contractual assessments at issue here.

Installation of improvements on private property, paid for by assessments with priority liens, was not new to California law with the passage of AB 811 in 2008, or even with the enactment

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A. Amado. *Capitalization of Energy Efficient Features Into Home Values in the Austin, Texas Real Estate Market.* Massachusetts Institute of Technology. June 2007. http://dspace.mit.edu/bitstream/handle/1721.1/39848/182760581.pdf.
R. Nevin and G. Watson. "Evidence of Rational Market Valuations for Home Energy Efficiency." *The Appraisal Journal*. October 1998. http://mpra.ub.uni-muenchen.de/35343/1/Nevin-Watson_1998_APJ_Market_Value_of_Home_Energy_Efficiency.pdf.
W. Pfleger, C. Perry, N. Hurst, and J. Tiller. *Market Impacts of ENERGY STAR Qualification for New Homes.* Appalachian State University. 2011. http://ncenergystar.org/sites/default/files/NCEEA_ENERGY_STAR_Market_Impact_Study.pdf.

Additional data can be found in the review article at http://www.buildingrating.org/content/efficiency-property-value.

of Chapter 29, authorizing Contractual Assessments, in 1987. The California Legislature has previously recognized that some hazards cannot be addressed without the cooperation of private property owners, and has established mechanisms to address these problems. Like adding improvements addressing climate change, each of these improvements provided special benefit to the privately-owned property, while also addressing a community issue. Examples of these statutes include:

- A Geologic Hazard Abatement District, pursuant to statutes enacted in 1979, may include both public and private land. (Cal. Pub. Res. Code § 26532.) The District may construct improvements on private property, but only with the consent of the property owner or through eminent domain. (Cal. Pub. Res. Code § 26580.) Improvements are paid for by assessments (§ 26650) which become a priority lien on the property until paid. (§ 26654.)
- The Improvement Act of 1911, the same Act which contains the provisions related to Contractual Assessments, also provides a remedy for abatement of geologic hazards. Through statutes added in 1980, the legislative body may undertake work to prevent, mitigate, abate, or control a geologic hazard. Such work may be performed on private property only with the written consent of the property owner. (Cal. Str. & Hwy. Code § 5105.) Work undertaken is funded by assessments (Cal. Str. & Hwy. Code § 5108.3.) The Assessments would have priority as provided in state law. (Cal. Gov. Code § 53935.)
- Work to bring privately owned buildings into compliance with seismic safety standards may be funded through assessments. No lot or parcel may be included in the district without the property owner's consent. (Cal. Str. & Hwy. Code § 10100.2, added to the Code by Stats. 1992, c. 18.)
- Work deemed necessary to bring privately owned buildings into compliance with seismic safety standards may also be funded through a Mello-Roos special tax, provided that all of the votes cast on the question of levying the tax vote in favor of the tax, or the property owners have previously consented to the tax. (Cal. Gov. Code § 53313.5.)

Never have the Enterprises taken the position that these assessments or any other assessments violate their Uniform Security Instrument, or are anything other than local government assessments.

We have included for the Agency's information a list of other assessments in place in the County, attached as "Exhibit A" to these comments. All of these assessments are supported by priority liens, as required by state law. The duration of the assessments, and the amount of the assessments, are not significantly different from the duration and amount of PACE assessments. Neither FHFA, nor the Enterprises, have regarded any of these assessments as problematic or "risky," nor have they ever questioned the State Legislature's ability to authorize the assessment, or the local governments' right to impose them. These assessments are no different than the assessments imposed for PACE improvements.

FHFA also argues that PACE as a community program addressing climate change "do[es] not have the traditional community benefit associated with" more traditional assessments such as street, water, and sewer improvements (FHFA July 6, 2010 Statement.) Ironically, this appears

to be the exact argument raised by mortgage holders in attacking assessments for street, water, and sewer improvements a century ago: building these types of improvements was not the "traditional" work of government. The Court in California soundly rejected this argument, and upheld the lien priority of a special assessment: "In modern times, whatever may have been the demands of society in an earlier period of the development of government, the necessity of improving the streets of cities and towns . . . is yet important and necessary to the welfare of the whole community ... ." *German Savings and Loan Society v. Ramish,* 138 Cal. 120, 124 (1902). In *these* modern times, addressing climate change is a challenge to government at all levels. As noted recently by Deputy Secretary of the United States Department of Housing and Urban Development Ron Sims in his written testimony to the House Appropriations Subcommittee on Transportation, Housing, and Urban Development: "Residential housing and the built environment more broadly are major contributors to energy consumption and global warming. Residential buildings alone account for 20 percent of U.S. carbon emissions, with the vast majority coming from detached single-family houses."[6] Greenhouse gas emissions from residential properties have increased 29.9 percent from 1990 to 2007.[7]

Modern government must find a way to address this challenge, and California has done so by authorizing an assessment mechanism that benefits the property with decreased utility bills, and benefits the community at the same time, with reduced greenhouse gas emissions. Assessments have always been a partnership between the property owner and the government, funding a special benefit to a piece of property with the public credit. This assessment is no different, and the FHFA's singling out of PACE assessments as a threat to the safety and soundness of the Enterprises is unsupported by a century of law and policy.

FHFA has invited views on whether the existing directives should be maintained, changed, or eliminated, and whether other restrictions or conditions should be in place. It is the County's view, based on our own experience and the experience of other existing PACE programs, that the existing programs are well-designed, no additional restrictions are necessary, and the directives should be withdrawn (the "No Action" Alternative).[8] There is no demonstrable risk to the Enterprises from the existing PACE programs; instead, it appears that the Enterprises are enjoying increased security on loans they own because of the added value of the improvements (over $45 million in Sonoma County); with de minimus exposure to risk on any individual project.

As FHFA has been informed, most state laws, including California law, do not allow a local government to accelerate the amount due on an assessment in the event of a delinquency. Only the unpaid, overdue amount would be due. Lenders can protect their interest by paying this amount; the Enterprises' Uniform Security Instrument grants the lender the right to add this amount to the mortgage due, and collect it from the property owner as part of the mortgage, with interest.

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[6] http://portal.hud.gov/hudportal/HUD?src=/press/testimonies/2010/2010-03-10.
[7] "Emission of Greenhouse Gases in the United States, 2007, p. 16, found at ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057307.pdf,.
[8] If FHFA interprets the Court's order to require a rule be promulgated, the proposed rule could be that PACE assessments be recognized as local government assessments, and treated the same as other assessments by the regulated entities.

Certainly, there is no support for the rule FHFA now proposes: to instruct the Enterprises not to purchase *any* mortgage in a jurisdiction with a PACE program. Nor is there any evidence that this would protect investments the Enterprises have already made in PACE jurisdictions: to the contrary, such rule would no doubt impede the transfer of property and undermine the goal of safety and soundness that FHFA purports to champion.

FHFA has requested that comments address specific questions posed by FHFA.

Question 1. *Are conditions and restrictions relating to FHFA-regulated entities' dealings in mortgages on properties participating in PACE programs necessary? If so, what specific conditions and/or restrictions may be appropriate?*

Based on its experience, Sonoma County does not believe any additional restrictions or conditions, beyond what local governments already are imposing, are appropriate or necessary. Existing safeguards developed by individual PACE programs or by state enabling legislation are sufficient to ensure the safety and soundness of mortgages that may exist on properties subject to PACE assessments. Improvements installed with PACE financing reduce property energy costs, and assist property owners in meeting their other obligations, such as making mortgage payments.

Actual experience of existing programs does not support FHFA's assumption of added risk. Rather, Sonoma County's experience demonstrates that properties enrolled in PACE programs have fewer tax and mortgage delinquencies than the general public:

- 2009-10 was the first year PACE assessments were placed on the tax bills. Total Secured tax delinquencies in the county that year were 3.3%. PACE assessment delinquencies were 1.19% as of 6/30/10. As of February 2012, the 2009-10 Secured tax delinquencies have dropped to .75%. PACE assessment delinquencies have dropped to .27%.

- 2010-11: Total Secured tax delinquencies in the county were 2.3%. PACE assessment delinquencies were 1.84% as of 6/30/11. As of February 2012, the 2010-11 Secured tax delinquencies have dropped to 1.1% PACE assessment delinquencies have dropped to .76%.

As compared, then, the delinquency rate of properties with a PACE assessment is much lower in comparison with county-wide delinquencies.

The County took the initiative to review any changes in the mortgage status of properties with PACE assessments. Of the 1,459 assessments placed on properties in Sonoma County, only 16 properties showed recorded documents demonstrating uncured mortgage defaults, an average of 1.1%. During the same timeframe (2009 through 2011), the average mortgage delinquency rate in Sonoma County varied from 8% to over 10%.[9] As compared, then, the default rate of properties with a PACE assessment was much lower in comparison with overall properties. This

[9] Financial, Real Estate & Creative Industries Insider 2011, p. 3. http://edb.sonoma-county.org/documents/2011/financial_realestate_creative_2011.pdf.

data does not support FHFA's assumption that PACE assessments create an added risk to the mortgage industry.

Like every other PACE program, Sonoma County has adopted a set of conditions and restrictions for eligibility for PACE programs. These restrictions and conditions appear to work well, and in our view adequately protect the interest of mortgage lenders. These include:

- The applicant is current on all liens against the property
- The applicant is current on all property taxes
- The owner is not in bankruptcy, and the property is not a bankruptcy asset
- There are no involuntary liens on the property
- Liens, including the proposed assessment lien, are less than 100% lien to value ratio (market value verified using automated valuation model with third party vendor)
- Improvements must be permanently affixed to the property
- The financing request is less than 10% of the market value of the property
- Commercial projects require:
    - Lender Acknowledgement
    - Utility Company Energy Evaluation

In addition, the County encourages applicants to pursue an energy audit to evaluate the efficacy and cost effectiveness of the proposed improvements. The County has worked with the State of California, California Energy Commission, to facilitate funding to reduce the cost of these audits for residential property owners, and to date over 400 property owners have taken advantage of this offer to learn more about their home's efficiency.[10]

If FHFA believes additional protections are required, despite the evidence that tax delinquencies and mortgage defaults are extremely low under the County's current conditions, FHFA could look to the Department of Energy PACE guidelines, or the provisions of proposed federal legislation HR2599, which suggest some additional restrictions. Although the County believes that these additional restrictions are unnecessary and would reduce participation in its Program, it would accept these standards in order to resolve its differences with FHFA.

Question 2: *How does the lien-priming feature of first-lien PACE obligations affect the financial risks borne by holders of mortgages affected by PACE obligations or investors in mortgage-backed securities based on such mortgages? To the extent that the lien-priming feature of first-lien PACE obligations increases any financial risk borne by holders of mortgages affected by PACE obligations or investors in mortgage-backed securities based on such mortgages, how and at what cost could such parties insulate themselves from such increased risk?*

As explained above, the County does not believe that the priority lien granted by state law to the PACE assessments creates any additional risk for mortgage lenders or investors in mortgage-backed securities. As addressed above, PACE assessments are no different than other assessments for public improvements, such as road, sewer, and water systems. In fact, PACE

[10] As noted *infra*, there have been substantial advances in the establishment of these metrics, so that home energy audits are now routinely available at a reasonable cost to property owners..

assessments support improvements installed directly on the property, ultimately owned by the property owner, that directly benefit the property by reducing utility costs.

If lenders are concerned about tax delinquencies, they can protect themselves from tax defaults by requiring taxes and assessments be paid monthly with the mortgage, and placed in an escrow account, as they routinely do. This would protect the lender from default in payment of other assessments as well.

Question 3: *How does the lien-priming feature of first-lien PACE obligations affect any financial risk that is borne by holders of mortgages affected by PACE obligations or investors in mortgage-backed securities based on such mortgages and that relates to any of the following: The total amount of debt secured by the subject property relative to the value of the subject property (i.e., Combined Loan to Value Ratio for the property or other measures of leverage); The amount of funds available to pay for energy-related home-improvement projects after the subtraction of administrative fees or any other program expenses charged or deducted before funds become available to pay for an actual PACE-funded project (FHFA understands such fees and expenses can consume up to 10% or more of the funds a borrower could be obligated to repay under some PACE programs); The timing and nature of advancements in energy-efficiency technology; The timing and nature of changes in potential homebuyers' preferences regarding particular kinds of energy-efficiency projects; The timing, direction, and magnitude of changes in energy prices; and The timing, direction, and magnitude of changes of property values, including the possibility of downward adjustments in values?*

As explained above, the County objects to FHFA's conclusion that PACE assessments are somehow different than other assessments, and require a different analysis. There is no basis for that assumption.

PACE programs can be structured to address the concerns expressed in this question related to lien to value ratio, as Sonoma has done. Sonoma has minimal fees for participation in its Program. There is no application fee, and we have a very reasonable title search fee, and very reasonable charge for determining market value. Recording of the lien is required by state law, and this fee is also passed through to the property owner. In all, fees are less than $250 for the initial processing and recording, and approximately $40 per year for servicing the assessment thereafter. The County has set an interest rate of 7 percent based on a review of the taxable bond rate over the past ten years. All fees and interest costs are disclosed to property owners before the owners make their decision on improvements and financing.

The other factors cited by FHFA in this question—possible changes in property owner preference, advances in technology, changes in energy prices and property values—must be addressed reasonably. FHFA appears to take the position that a property owner should remain paralyzed in moving forward on energy improvements because something might change. As with any purchase, or any improvement, the property owner must conduct the best evaluation possible on whether the proposed improvement makes economic sense. In Sonoma County, property owners have expert, objective assistance in making this determination. Our Program staff is up to date on all efficiency and renewable information and statistics to assist with that determination, and we also recommend that a property owner engage an energy auditor to assist

in evaluating considered improvements. As other commenters have noted, energy prices, while volatile, have trended upwards this decade. There is no reason to assume that trend will not continue. Property values, of course, have declined. However, common sense dictates that an energy improvement that pays for itself should not adversely impact the value of property. There is no evidence in Sonoma County's history that it does.[11] As noted in the response to Question 1 above, it has been Sonoma's experience that delinquency and default rates on properties with PACE mortgages are extremely low, possibly reflecting a self-selecting group of participants (i.e., property owners committed to bettering and retaining their properties) or decreased exposure to the other financial stresses of home ownership because of the improved, more efficient improvements.

Question 4: *To the extent that the lien-priming feature of the first-lien PACE obligations increases any financial risk that is borne by holders of mortgages affected by PACE obligations or investors in mortgage-backed securities based on such mortgages and that relates to any of the following, how and at what cost could such parties insulate themselves from that increase in risk: [same factors contained in Question 3 above]?*

As discussed above, given the very low tax delinquency rate and mortgage default rate on PACE properties, the County does not believe PACE assessments impose any additional risk on mortgage holders or investors in mortgage-backed securities. In fact, the total value of improvements, compared to the risk of possible default or delinquency, almost certainly leaves such investors better protected over all.

Fannie Mae and HUD both have energy efficiency mortgages available to the public, and methods to measure the value of energy improvements funded by those mortgage products.[12] Although some property appraisers have in the past neglected to account for the value added to a home by energy improvements, we note that the Appraisal Institute has recently developed an addendum to the common appraisal form which would allow an appraiser to more readily capture value for these improvements.[13] We are optimistic that lending practice is evolving to recognize the value of these improvements; and we are optimistic that FHFA will adjust its view on energy improvements in light of the evidence that these improvements add value to property, and such value can now be recognized by appraisers.

Also as suggested above, if lenders are concerned about tax delinquencies, they can protect themselves from tax defaults by requiring taxes and assessments be paid monthly with the mortgage, and placed in an escrow account. This would protect the lender from default in payment of other taxes and assessments as well, and would not impose any additional cost or risk on the lender.

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[11] Also, see studies cited in footnote 5 regarding reported property value increases resulting from energy improvements, and response to Question 10, infra.

[12] The County does not have information on the popularity of these programs, or why they have failed to gain popularity with lenders or consumers.

[13] http://www.appraisalinstitute.org/education/downloads/AI_82003_ReslGreenEnergyEffAddendum.pdf

Question 5: *What alternatives to first-lien PACE loans (e.g., self-financing, bank financing, leasing, contractor financing, utility company "on-bill" financing, grants, and other government benefits) are available for financing home-improvement projects relating to energy efficiency? On what terms? Which do and which do not share the lien-priming feature of first lien PACE obligations? What are the relative advantages and disadvantages of each, from the perspective of (i) the current and any future homeowner-borrower, (ii) the holder of an interest in any mortgage on the subject property, and (iii) the environment?*

Given the enthusiasm with which our PACE program was welcomed by both the property owner and contractor communities, it appears that whatever alternative financing methods are available for energy improvements are not effectively working. For the past few years, scant home equity has been available, although it appears that market might be becoming more active. As FHFA is well aware, there are some grant programs available, and there are some state programs where the lien related to the energy improvement is not a priority lien (i.e., Vermont and Maine); however, we are not aware whether those programs are effectively functioning, or whether they will be replicable after initial federal or state subsidies are used up. As Sonoma County has demonstrated, PACE programs are replicable, and need no federal or state funding to become operational. Assuming some resolution is reached with FHFA, we would expect that the financial community (indeed, some of the same institutions that are mortgage lenders) would be willing to purchase local agency bonds so that PACE programs can sustain growth.

As discussed above, the repayment of the cost of improvements, whether they are energy improvements, water system improvements, etc., must be ensured by a lien that will not be wiped out in the event of a mortgage foreclosure. Most PACE programs, including SCEIP and all PACE programs in California, have liens that do not accelerate in the event of a default (i.e., only the delinquent amount is due; the remainder of the lien remains on the property, even if the property is sold).[14] Thus the amount due from any delinquency on the assessment would be small. A mortgage lender would retain the value of its loan. If the PACE lien were subordinate, however, in the event of a mortgage delinquency a subordinate PACE lien would likely be eliminated. This would completely prevent the development of a meaningful capital market for PACE bonds. As one expert in the capital market noted: "After careful analysis of the municipal bond market and the ratings industry, we conclude that there would be little to no meaningful bond buyer interest in pari passu or subordinated PACE liens and therefore the PACE bond market would be highly unlikely to develop."[15]

Although as noted above there are energy mortgage products available, they do not appear to have captured any significant market segment. Thus in the current market there appears to be a stark choice: If PACE programs can proceed, energy improvement projects can be done.

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[14] Accelerating the Payment of PACE Assessments. Zimring, Mark, and Fuller, Merrian (May 4, 2010). http://eetd.lbl.gov/ea/ems/reports/ee-policybrief_050410.pdf.

[15] Letter from Barclays Capital to Jeffrey Tannenbaum, dated September 14, 2009., available at: http://pacenow.org/documents/Pace%20letter%20sept%202009%20re%20liens%20_2_%20_2_%20-%20Barclays%20%209-14-09%20_3_.pdf

Without PACE, projects cannot be financed. In the long run, this thwarts federal policy[16] and advantages no one: not the property owner, nor the lender, and certainly not the public interest.

Question 6: *How does the effect on the value of the underlying property of an energy-related improvement project financed through a first-lien PACE program compare to the effect on the value of the underlying property that would flow from the same project if financed in any other manner?*

This response would depend on the total cost of the project, including interest. The project financed at the lowest interest rate would be the most cost effective for the property and property owner. Currently, under federal tax law, bonds to support PACE projects must be sold as taxable bonds, making interest rates somewhat high. Sonoma County imposes a 7 percent interest rate on its SCEIP assessments, based on its analysis of the taxable bond interest rate for the 10 years preceding the commencement of the Program. If home equity is available to a property owner at a lower rate, then it may benefit the property owner to seek out those funds. As part of our property owner education, we advise applicants of that option.

Question 7: *How does the effect on the environment of an energy-related home-improvement project financed through a first-lien PACE program compare to the effect on the environment that would flow from the same project if financed in any other manner?*

See response to Question 8, below.

Question 8: *Do first-lien PACE programs cause the completion of energy-related home improvement projects that would not otherwise have been completed, as opposed to changing the method of financing for projects that would have been completed anyway? What, if any, objective evidence exists on this point?*

Data from Sonoma County projects supports the conclusion that the availability of the County's PACE program results in energy projects being completed that otherwise would not have been done. SCEIP has financed 7.7 megawatts of solar installations: 19 percent of the total installations in the County.[17] Given the economy and unavailability of home equity financing, or other type of financing to most property owners, in our view those projects would not have been completed without Sonoma's PACE program.

Below is a table listing a summary of solar energy improvements funded through Sonoma County's PACE program, and listing its effect on the environment:

[16] For over a decade it has been federal policy "to expedite projects that will increase the production, transmission, or conservation of energy." Executive Order 13212, dated May 18, 2001. http://www.gpo.gov/fdsys/pkg/FR-2001-05-22/pdf/01-13117.pdf.

[17] California CSI website: http://www.californiasolarstatistics.org/reports/locale_stats/.

Solar Summary - Improvements funded through SCEIP 3/25/2009 - 3/01/2012					
	Number of Systems	**Total Watts**	**Est. annual kWh production***	**Est. annual electricity savings***	**Est. annual carbon emissions saved* (tons)**
Residential	988	5709184	8,335,409	$1,548,802	3,459
Commercial	40	2018565	2,947,105	$547,602	1,223
TOTAL	**1028**	**7727749**	**11,282,514**	**$2,096,404**	**4,682**

In terms of annual avoided greenhouse gas emissions, the solar improvements funded by SCEIP are the equivalent of removing over 800 averages cars from the road.[18]

The table does not reflect all of the energy and environmental benefits of the Program. In addition, the County has financed 1614 energy efficiency projects, including such improvements as installing efficient HVAC systems, cool roofs, efficient water heaters, efficient windows and doors, upgrading lighting, and installing sealing and insulation. These projects resulted in additional energy savings for consumers and avoided emissions.

Again, if other funding were available for these projects at a lower cost, we assume a rational property owner would have migrated to that funding. We are proud that we have been able to have such a profound effect on the environment in these difficult times.

Question 9: *What consumer protections and disclosures do first-lien PACE programs mandate for participating homeowners? When and how were those protections put into place? How, if at all, do the consumer protections and disclosures that local first-lien PACE programs provide to participating homeowners differ from the consumer protections and disclosures that non-PACE providers of home improvement financing provide to borrowers? What consumer protection enforcement mechanisms do first-lien PACE programs have?*

We have attached as "Exhibit B" a copy of the County's SCEIP application and disclosure documents. We have not examined other lenders' disclosure documents to see how they compare to those used by SCEIP but assume that FHFA can do so if it believes that is relevant.

In addition, we have extensive educational information and links available at the SCEIP website, www.sonomacountyenergy.org.

The County additionally requires that all applicants obtain a permit for work to be performed, and funds will not be disbursed until work has been inspected and approved by a city or county building inspector. Work can only be performed by a licensed contractor. The SCEIP office verifies that any contractor's license is current before approving an application.

[18] See http://www.epa.gov/otaq/consumer/f00013.htm.

Staff in processing an application verifies that the cost proposed is within the range of cost expected for that type of improvement. Improvements must be reasonable for the property, and the cost cannot exceed 10 percent of the market value of the property.

Question 10: *What, if any, protections or disclosures do first-lien PACE programs provide to homeowner-borrowers concerning the possibility that a PACE-financed project will cause the value of their home, net of the PACE obligation, to decline? What is the effect on the financial risk borne by the holder of any mortgage interest in a subject property if PACE programs do not provide any such protections or disclosures?*

The County is not aware of *any* evidence that energy efficiency and renewable energy improvements cause a decline in property value.

In addition to those resources referenced in footnote 5, the following studies support the conclusion that these improvements add value to property:

A New Market Paradigm for Zero-Energy Homes: The Comparative San Diego Case Study, available at http://www.nrel.gov/docs/fy07osti/38304-01.pdf, excerpts of which are attached as "Exhibit C";
Evidence of Rational Market Valuations for Home Energy Efficiency, The Appraisal Journal (October 1998), attached as "Exhibit D," available at: http://www.icfi.com/Markets/Community_Development/doc_files/apj1098.pdf; and
An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California, (2011), excerpts of which are attached as "Exhibit E," available at: http://eetd.lbl.gov/ea/emp/reports/lbnl-4476e.pdf.

The County also notes that based on the development of national and statewide standards, home efficiency metrics now allow purchasers to more easily compare the energy efficiency of homes and buildings. For example, the U.S. Department of Energy currently is working on developing a Home Energy Score (HES) program. As DOE notes on its website:

> The Home Energy Score allows a homeowner to compare her or his home's energy consumption to that of other homes, similar to a vehicle's mile-per-gallon rating. A home energy assessor will collect energy information during a brief home walk-through and then score that home on a scale of 1 to 10. A 10 would represent a home with excellent energy performance whereas a 1 would represent a home that needs extensive energy improvements or energy upgrades. The home energy assessor will provide the homeowner with a list of recommended energy improvements and the associated cost savings estimates as well as the Home Energy Score.[19]

State law will shortly require similar disclosures for commercial buildings, and the California Energy Commission is currently in rulemaking.[20] The CEC has also developed the Home

[19] See http://www1.eere.energy.gov/buildings/homeenergyscore/.
[20] See http://www.energy.ca.gov/ab1103/.

Energy Rating System (HERS) Whole House Rating Program, to objectively score home based energy features. The County partnered with CEC to provide low-cost energy audits to interested property owners, and over 400 home energy audits have been performed through this partnership. As information about homes' energy efficiency becomes more accessible, and purchasers can more easily compare similar homes, the substantial value of efficiency and renewable energy improvements will only become better reflected in the marketplace.

Question 11: *What, if any, protections or disclosures do first-lien PACE programs provide to homeowner-borrowers concerning the possibility that the utility-cost savings resulting from a PACE-financed project will be less that the cost of servicing the PACE obligation? What is the effect on the financial risk borne by the holder of any mortgage interest in a subject property if first-lien PACE programs do not provide such protections or disclosures?*

Improvements that may be installed with County PACE financing are limited to pre-approved measures that are demonstrably effective as efficiency measures, or renewable energy production measures. These are listed in the Program Guidelines, available at http://drivecms.com/uploads/sonomacountyenergy.org/program_report_and_administrative_guidelines.pdf, beginning at page 14. Disclosures regarding utility cost savings are contained in the County's SCEIP application, attached as Exhibit B. The County encourages property owners to conduct their own due diligence, and assists property owners with subsidies toward the cost of an energy audit. The County also provides informational material through its website and through SCEIP office staff. The County does not believe there is any effect on the financial risk to lenders or mortgage investors regarding disclosures to property owners related to potential utility costs.

Question 12: *What, if any, protections or disclosures do first-lien PACE programs provide to homeowner-borrowers concerning the possibility that over the service life of a PACE-financed project, the homeowner-borrower may face additional costs (such as costs of insuring, maintaining, and repairing equipment) beyond the direct cost of the PACE obligation? What is the effect on the financial risk borne by the holder of any mortgage interest in a subject property if first-lien PACE programs do not provide any such protections or disclosures?*

Disclosures regarding potential additional maintenance costs are contained in the County's SCEIP application, attached as Exhibit B. The County encourages property owners to conduct their own due diligence. Generally, property owners expect that with any piece of equipment some routine maintenance, and possible replacement parts, will be necessary to receive the full advantage of the equipment. The County does not believe there is any effect on the financial risk to lenders or mortgage investors regarding disclosures to property owners related to potential maintenance costs.

Question 13: *What, if any, protections or disclosures do first-lien PACE programs provide to homeowner-borrowers concerning the possibility that subsequent purchasers of the subject property will reduce the amount they would pay to purchase the property by some or all of the amount of the outstanding PACE obligation? What is the effect on the financial risk borne by the holder of any mortgage interest in a subject property if first-lien PACE programs do not provide any such protections or disclosures?*

Before FHFA issued its anti-PACE Statement, properties in Sonoma County with PACE assessments were able to refinance and transfer without difficulty. There did not appear to be any adverse consequence to the lender, the property owners, or the purchasers as a result of the PACE assessment and lien. By having the Enterprises require that the PACE lien be paid off at the time of any transfer, FHFA has effectively reduced the pool of potential purchasers for property (because the property is transferring unencumbered, a higher price would be demanded, and fewer potential buyers will qualify). Thus the actions of the Enterprises themselves would appear to have a negative effect on their own interest.

As previously noted in footnote 5 and the response to Question 10, energy efficiency and renewable energy improvements typically increase the value of property. Thus the County does not believe there is any effect on the financial risk to lenders or mortgage investors regarding disclosures to property owners on this topic.

Question 14: *How do the credit underwriting standards and processes of PACE programs compare to that of other providers of home-improvement financing, such as banks? Do they consider, for example: (i) borrower creditworthiness, including an assessment of total indebtedness in relation to borrower income, consistent with national standards; (ii) total loan-to-value ratio of all secured loans on the property combined, consistent with national standards; and (iii) appraisals of property value,, consistent with national standards?*

How this question is framed reflects FHFA's fundamental misunderstanding of the nature of PACE programs, and its refusal to acknowledge the plain language of PACE laws, including California's PACE law. FHFA contends this financing is a loan, therefore requiring treatment and evaluation as a loan, with focus on the creditworthiness of the borrower. However, as a matter of law, the PACE transaction is an assessment, not a loan. It is a land-based and land-secured transaction.

This is well explained in Property Assessed Clean Energy ("Pace") Programs, White Paper: Helping Achieve Environmental Sustainability And Energy Independence, Improving Homeowner Cash Flow And Credit Profile, Protecting Mortgage Lenders, And Creating Jobs[21]:

> PACE programs were developed on well established legal principles, applied to the unique challenges that must be met to promote widespread adoption of energy efficiency measures and to meaningfully reduce carbon dioxide emissions and provide for economic security. They are based on sound constitutional principles as laid out over the years by the courts. They rely on a building block of the municipal finance system – **the land-secured financing district**– rather than on federal and state consumer laws. The hallmark of a consumer loan is the borrower's personal promise to repay the principal amount advanced by the lender. In contrast, **PACE programs**

[21] Prepared by the National Resources Defense Council, PACENow, Renewable Funding LLC, and the Vote Solar Initiative, and available at: http://pacenow.org/documents/PACE%20White%20Paper%20May%203%20update.pdf

> **involve an assessment on property that is improved with funds provided by the governmental body.** (emphasis added.)

It is this concept—that the improvement directly benefits and adds value to the property, and offsets the cost of the assessment—that distinguishes PACE financing from traditional Home Equity financing, where loan proceeds can be spent at the discretion of the borrower. PACE programs insure that the assessment amount is spent only on designated, pre-approved improvements.

Nevertheless, most PACE programs have incorporated some prudent measures out of deference to mortgage lenders' concerns. For example, SCEIP limits the size of improvements to no more than 10 percent of the market value of a property; and will not approve an assessment if the total liens on the property would exceed the market value of the property. Market value is determined using a methodology common in the mortgage industry. In addition, SCEIP requires that property owners be current on all mortgages and loans on the property, and current on all taxes. If the property owner has been in bankruptcy in the past three years, additional requirements are imposed.

In establishing this rule, FHFA must keep the public interest in mind, and consider the effect of its actions on the environment. The more stringent the rule, the fewer applicants will qualify. Each rejected project has a negative effect on accomplishing the environmental policy goal of reducing greenhouse gas emissions. The low delinquency and default rates on participating Sonoma County PACE properties demonstrate that the County has established an appropriate balance between the competing interests of mortgage lenders and investors, and in promoting the public interest through its PACE program.

Question 15: *What factors do first-lien PACE programs consider in determining whether to provide PACE financing to a particular homeowner-borrower seeking funding for a particular project eligible for PACE financing? What analytic tools presently exist to make that determination? How, if at all, have the methodologies, metrics, and assumptions incorporated into such tools been tested and validated?*

Program eligibility criteria are set out in response to Question 1, and Question 14, above. That the "methodologies, metrics, and assumptions" are effective is evidenced by the extremely low default and delinquency rates among SCEIP participants.

Question 16: *What factors and information do first-lien PACE programs gather and consider in determining whether a homeowner-borrower will have sufficient income or cash flow to service the PACE obligation in addition to the homeowner-borrower's pre-existing financial obligation? What analytic tools presently exist to make that determination? How, if at all, have the methodologies, metrics, and assumptions incorporated into such tools been tested and validated?*

As discussed throughout these comments, completion of the improvements results in offsetting the cost of utility payments. The County strongly encourages applicants to engage a trained auditor to evaluate the most economic, cost effective measures that can be taken to achieve the

property owner's desired energy savings. Properly sized projects result in no additional annual cost to the property owner, and overall should achieve cost savings.

Question 17: *What specific alternatives to FHFA's existing statements about PACE should FHFA consider? For each alternative, as compared to the Proposed Action, what positive or negative environmental effects would result and how would the level of financial risk borne by holders of any interest in a mortgage on PACE-affected properties change?*

Sonoma County has presented data demonstrating that on the whole its PACE program results in improvements to property that benefit the public interest, the property holder, and the mortgage holder as well. Participants in the PACE program have low tax delinquency rates and low mortgage default rates. The PACE improvements add extra value, and thus extra security, to the mortgage. PACE programs serve the public interest by promoting clean energy, and creating jobs. Sonoma County therefore urges FHFA to decline adopting its Proposed Action, and consider adopting its "No Action" alternative by withdrawing its Statements and taking no additional action. Alternatively, FHFA could issue a rule directing its regulated and conserved entities to treat PACE assessments in the same manner they treat other assessments and property taxes.

If FHFA believes national standards are required to fulfill its obligation as regulator and conservator of the Enterprises, Sonoma County would urge FHFA to consider adopting the standards set out in HR2599, which has been sponsored and endorsed by many members of Congress, and was developed with some input from existing PACE programs. Although imposing the limitations in HR2599 would result in ineligibility of some potential applicants, resolving the ongoing dispute with FHFA would, in our view, result in other applications to Sonoma County's Program who are deterred by FHFA's position, and would allow other PACE programs to launch. Overall this would result in a benefit to the environment.

EIS SCOPING COMMENTS

As noted in the County's introductory comments, the residential real estate market is a significant contributor to greenhouse gas emissions, and those emissions have been increasing in recent years.

As noted recently by Deputy Secretary of the United States Department of Housing and Urban Development Ron Sims in his written testimony to the House Appropriations Subcommittee on Transportation, Housing, and Urban Development: "Residential housing and the built environment more broadly are major contributors to energy consumption and global warming. Residential buildings alone account for 20 percent of U.S. carbon emissions, with the vast majority coming from detached single-family houses."[22] Greenhouse gas emissions from residential properties have increased 29.9 percent from 1990 to 2007.[23]

[22] http://portal.hud.gov/hudportal/HUD?src=/press/testimonies/2010/2010-03-10.
[23] "Emission of Greenhouse Gases in the United States, 2007, p. 16, found at ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057307.pdf,.

Sonoma County has demonstrated that its program is responsible for a significant portion (19%) of the solar power installed in the County:

Data from Sonoma County projects supports the conclusion that the availability of the County's PACE program results in energy projects being completed that otherwise would not have been done. SCEIP has financed 7.7 megawatts of solar installations: 19 percent of the total installations in the County.[24] Given the economy and unavailability of home equity financing, or other type of financing to most property owners, in our view those projects would not have been completed without Sonoma's PACE program. Additional information on solar and efficiency measures is presented in the response to Question 8, above.

The status quo before FHFA's anti-PACE action was that SCEIP was thriving and was assisting the County in meeting its ambitious climate objectives. FHFA's actions disrupted this status quo. As of September, 2011, SCEIP had experienced a 57% decline in applications and participation in its residential program. It was the opinion of SCEIP staff that this significant decline was the result of FHFA's position and instructions to the Enterprises. Immediately following issuance of the July 6, 2010, Statement, applications to SCEIP dropped from a monthly average of 116 to 60. The detriment to the environment is clear. Accordingly we strongly urge FHFA in its environmental review to objectively and fully consider alternatives to its flat ban on PACE programs.

Thank you for your attention to this critically important matter.

Respectfully,

Shirlee Zane
Chairwoman, Board of Supervisors

Attachments: Exhibit A-E

[24] California CSI website: http://www.californiasolarstatistics.org/reports/locale_stats/.

EXHIBIT A

Sonoma County - 2010 List of Property Tax/Special Assessments that are Analogous to PACE

Tax Code #	District Name & Issuing Authority	Improvements Constructed	First Year on Roll (1)	Last Year on Roll	Term of Original Bonds	Original Bond Amount (2)	Current Number of Parcels (3)	Assessment Range (4)	Average Assessment Amount (4)	Is debt senior to first mortgage
61101	Specific Plan Area A - 2005 Refunding - City of Healdsburg	Roadway grading and paving, curbs and gutters, street lights, undergrounding utilities, storm drains, sewer and water mains	2005	2014	20	$2,666,021	387	$2,484 - $17,068	$3,773	Yes
61301	Mitchell/Shiloh/Conde Asmt Dist - Town of Windsor	Road widening & paving; striping, signing & street lights; curbs, gutters, & sidewalks; installation of sewer laterals & water service; drainage system; landscape improvements, etc.	2005	2025	20	$5,210,000	21	$59,106 - $1,365,101	$233,321	Yes
61900	Mirabel Heights Sewer Assmt Dist - Forestville Co. Water District (Formerly CSA 41)	Sewer system installation - [Assets & Liabilities (including bond debt & responsibilities) transferred 7/1/04 to Forestville Water Dist.]	1999	2037	39	$1,762,400	198	$7,805 - $24,998	$8,570	Yes
62401	South Sonoma Business Park Asmt Dist- City of Cotati	Wetlands & salamander habitat mitigation	2003	2032	30	$5,875,000	53	7 Com - $120K - $2.4M 46 Res - $11.8K - $16.4K	Com - $755,884 Res - $12,692	Yes
63100	Mirabel Heights Assmt Dist - Forestville Co. Water Dist	Acquisition of existing private water system, installation of new water system	1980	2018	29	$125,569	149	$65 - $1,140	$722	Yes
63400	Occidental Community Services Dist - Water Improvement Project No. 1	Construction of water system, including dam improvements, water treatment plant, transmission lines, and connection to existing system	1988	2026	39	$169,000	83	$1,837 - $9,175	$2,036	Yes
63401	Occidental Community Services Dist - Water Supply Asmt Dist No. 2003-1	Construction of water well, booster pumping stations, and transmission mains	2005	2043	39	$990,000	102	$2,417 -$115,158	$10,109	Yes
64100	Russian River County Water District - Assmt Dist #1	Acquisition of existing private water system and improvements, including wells, pipes, tanks, pumps, and connection to an existing system	1986	2024	39	$133,895	768	$1,025 - $7,575	$2,433	Yes
64201	Russian River County Water District - 2009-1 Hollydale	Acquisition of existing private water system and improvements, including wells, pipes, tanks, pumps, and connection to an existing system	2009	2048	39	$268,272	27	$9,936	$9,936	Yes
64202	Russian River County Water District - 2009-2 Rural Canyon	Acquisition of existing private water system and improvements, including wells, pipes, tanks, pumps, and connection to an existing system	2009	2048	39	$540,000	21	$26,000	$26,000	Yes
64203	Russian River County Water District - 2009-3 Marigold	Acquisition of existing private water system and improvements, including wells, pipes, tanks, pumps, and connection to an existing system	2009	2048	39	$337,716	6	$56,286	$56,286	Yes
64700	Sunnyslope Assessment District - County of Sonoma	Curb, gutter, sidewalk, and paving improvements to existing roads, as well as storm drain, sanitary sewer, fire hydrant assemblies, and undergrounding electric utility lines.	1991	2010	19	$817,627	67	$2,024 - $66,975	$5,963	Yes
65600	Windsor County Water District #4	Installation of water system	1977	2015	39	$168,692	54	$81 - $3,934	$1,028	Yes
66500	Summerhome Park Assmt Dist - Russian River Co Water	Installation of domestic water storage and distribution facilities	1995	2033	39	$1,080,210	152	$4,982 - $20,946	$7,015	Yes
66800	Larkfield Sewer Reassmt. 1997-1 - County of Sonoma	Sewer system in existing neighborhood.	1997	2010	20	$1,655,214	59	$3,876 - $160,682	$14,982	Yes
66900	So. Santa Rosa Ave. Reassmt. 1997-1 - County of Sonoma	Road widening, curb, gutter, and sidewalk improvements, as well as street lighting and water.	1997	2008	20	$2,286,709	92	$927 - $57,873	$15,314	Yes
67000	Vinecrest Road Reassmt 1997-1 - County of Sonoma	Road widening and paving improvements, as well as sewer and water systems.	1997	2010	20	$2,602,514	385	384 Res - $1,490 - $9,265 1 Bulk - $186,016	Res - $4,319 Bulk - $186,016	Yes

Sonoma County - 2010 List of Property Tax/Special Assessments that are Analogous to PACE

Tax Code #	District Name & Issuing Authority	Improvements Constructed	First Year on Roll (1)	Last Year on Roll	Term of Original Bonds	Original Bond Amount (2)	Current Number of Parcels (3)	Assessment Range (4)	Average Assessment Amount (4)	Is debt senior to first mortgage
67300	Hacienda Assmt Dist - Russian River County Water District - County of Sonoma	Acquisition of existing private water system, and improvements or replacements, including reservoirs, pipes, and pumps; connection to District system; and abandonment of existing system	1999	2037	39	$1,325,520	164	$5,000 - $15,612	$8,082	Yes
67400	Canon Manor West Assmt District - County of Sonoma	Grade & pave roads, water, sewer, and storm drain installation (some parcels include sewer hook up fee)	2006	2030	25	$4,866,576	144	$5,271 - $53,314	$32,214	Yes
76501	Lakeville Highway #24 2004 Consolidation - Petaluma	Grading & paving, storm drain system, signalization, relocation of utilities, etc.	2004	2020	25	$2,572,611	227	59 Comm - $2,406 - $187,955 168 Res - $303 - $1,090	Com - $33,697 Res - $636	Yes
81900	Eighth St East Sewer Assmt Dist - Sonoma Valley Sanitation Dist	Installation and construction of sewer system	1998	2017	20	$2,945,000	30	$7,657 - $1,200,030	$97,714	Yes
82500	Santa Rosa Ave Fire Protection Assmt Dist - Santa Rosa	Fire Protection improvements	1994	2014	20	$754,697	48	$3,494 - $55,443	$15,529	Yes
82700	Skyhawk Refunding Assmt Dist - Santa Rosa	Grading, paving, sidewalks, water, sewer and storm drain systems, underground utilities, park construction, water reservoir, street lights, etc.	1997	2019	25	$6,700,000	511	1 Comm - $63,868 510 Res - $10,219 - $13,755	Comm - $63,868 Res - $12,496	Yes
83900	Nielsen Ranch Assmt Dist - Santa Rosa	Water & Sewer systems, grading & paving Lake Park Drive	1996	2021	25	$2,750,000	107	3 Bulk - $97,590 - $676,622 104 Res - $10,403 - 28,626	Bulk - $328,552 Res - $16,182.90	Yes
86000	Townhouses Refunding Assmt Dist - Santa Rosa	Water distribution system, sewer collection system, & storm drain system	1998	2014	20	$2,995,000	264	$6,973 - $12,603	$10,027	Yes
86100	Fountaingrove Parkway Extension Reassmt Dist - Santa Rosa	Grading, paving, sidewalks, water, sewer and storm drain systems, underground utilities,street signs, street lights, etc.	1998	2018	25	$16,725,000	588	$17,812 - $62,916	$26,206	Yes
92801	McNear Landing Assmt Dist #25 2004 Consolidation - Petaluma	Grading, paving, sidewalks, water, sewer and storm drain systems, underground utilities,street signs, street lights, etc.	2004	2017	20	$1,800,000	185	$7,206	$7,206	Yes

Notes:

(1) First year on roll for Refunded, Reassessed or Consolidated Bonds

(2) Reflects original Bond amount prior to Refunding, Reassessment or Consolidation

(3) Parcels on Tax Roll for most recent year

(4) Comm=Commercial Res=Residential Bulk=Undivided parcels with multiple assessments

EXHIBIT B

[Date Received]

ENERGY INDEPENDENCE

File No. _____

Sonoma County Energy Independence Program

ALERT: Fannie Mae/Freddie Mac Instructions for Lenders

SINGLE FAMILY HOME OWNERS: In May, 2010, Fannie Mae and Freddie Mac, government sponsored enterprises that purchase a large segment of conforming single family home mortgages, issued new instructions to lending institutions on how to treat properties with assessments under Property Assessed Clean Energy (PACE) programs such as SCEIP. These letters, and additional statements issued by the Federal Housing Finance Agency, the agency that regulates single family home lenders, instruct lenders to treat energy assessments as "loans" instead of "assessments." Copies of these letters and statements can be viewed at the following links or may be obtained upon request from the SCEIP storefront:

- https://www.efanniemae.com/sf/guides/ssg/annltrs/pdf/2010/ll1006.pdf
- http://www.freddiemac.com/sell/guide/bulletins/pdf/iltr050510.pdf
- http://www.fhfa.gov/webfiles/15884/PACESTMT7610.pdf
- http://www.fhfa.gov/webfiles/15963/PACE_ststament_7_14_10.pdf

On August 31, 2010, the agencies issued additional instructions to lenders that Fannie Mae and Freddie Mac "will not purchase mortgage loans secured by properties with an outstanding PACE obligation." These letters can be viewed at:

- https://www.efanniemae.com/sf/guides/ssg/annltrs/pdf/2010/sel1012.pdf
- http://www.freddiemac.com/sell/guide/bulletins/pdf/bll1020.pdf

These letters and statements may lead lenders to conclude the assessment should be paid off before a property transfers or is refinanced. In addition, it may lead some lenders to conclude that participating in SCEIP is a violation of typical mortgage terms prohibiting prior liens without lender consent. If you are selling your property, a buyer's lender may refuse to finance a loan unless the assessment is paid off. Sonoma County disagrees with these instructions and is working to modify this position. We urge you to carefully read the disclosure information in the SCEIP application, review your mortgage documents, evaluate the risks of proceeding with an application at this time, and contact your lender if you have any concerns or for information regarding any other financing options that may be available to you.

I/We have read the above statement. All property owners on title must initial below:

_____	_____	_____	_____
Initials	*Date*	*Initials*	*Date*
_____	_____	_____	_____
Initials	*Date*	*Initials*	*Date*

File No. _____

ENERGY
INDEPENDENCE
A SONOMA COUNTY PROGRAM

APPLICATION INSTRUCTIONS

Please complete and sign the attached Application form and include all requested attachments. Please type or print neatly in blue or black ink.

All applications are processed on a first-come, first-served basis, upon receipt, until funds are depleted. Incomplete or incorrect applications cannot be processed. Resubmitted applications are processed on a first-come, first-served basis upon the new receipt date.

Application approval and execution of an Assessment Contract and an Implementation Agreement ("Contract Documents") are required before any financing is available. Sample Contract Documents can be viewed online at www.sonomacountyenergy.org. All record owners must sign the Application, Truth in Lending Disclosure Acknowledgment (TILA), and Contract Documents, as applicable. See Summary of Sonoma County Energy Independence Program Financing Process for more detailed information.

If there are insufficient funds available, an approved applicant will be placed on a waiting list.

Keep a copy for your records of your completed Application and all documents submitted. Keep a copy of all receipts, paid invoices, and home improvement contracts.

Mail or deliver your completed Application and attachments to: 404 Aviation Boulevard, Suite 200, Santa Rosa, CA 95403-1076. Applications and attachments can also be emailed to sceip@sonoma-county.org. For questions regarding the status of your Application call (707) 565-6470 or email sceip@sonoma-county.org.

For information on home improvement contracts or the status of the state license for your proposed contractor visit www.cslb.ca.gov or call the Contractor's State License Board at 1-800-321-CSLB. For information regarding residential and commercial energy analyses visit www.pge.com or https://www.calcerts.com/

File No. _____

Sonoma County Energy Independence Program

APPLICATION

The Sonoma County Energy Independence Program ("SCEIP") provides financing for the installation of energy efficiency improvements, water efficiency improvements, and renewable energy sources that are permanently fixed to real property ("Improvements"). Assessment Contracts and Implementation Agreements will be entered into as provided for in State law, Chapter 29 of Part 3 of Division 7 of the California Streets and Highways Code (commencing with Section 5898.10) and the Sonoma County Energy Independence Program Report and Administrative Guidelines.

SECTION 1: Eligibility Requirements

- Applicant(s) is/are legal owner of the property described in the Application (the "Property").
- Property is developed and located within Sonoma County. Mobile homes that are not affixed to real property and subject to secured property tax are not eligible.
- Property Owner is current on all property taxes for all properties owned in Sonoma County.
- Property Owner is current on all mortgage(s)[1]. For commercial property[2], lender has signed the Lender Acknowledgment form for SCEIP Financing.
- Property Owner is not in bankruptcy and the property is not an asset in a bankruptcy[3].
- There are no federal or state income tax liens, judgment liens, or similar involuntary liens on the Property.
- Improvement costs are reasonable for the scope of the proposed project and to Property value.
- Requested Financing Amount does not exceed 10 percent of the Property Market Value.[4]
- The lien to value ratio (excluding the Requested Financing Amount) does not exceed 100 percent[5].
- Total annual property taxes, plus current assessments, including projected annual SCEIP assessments due on the property do not exceed 5% of the property's market value, as determined at the time of approval of the contractual assessment.
- A 10% reduction in overall energy use must be attained prior to receiving SCEIP financing for any renewable generation project (i.e., solar) on the property.[6]

For further information on eligibility requirements, see the Program Report and Administrative Guidelines, or contact SCEIP staff at (707) 565-6470.

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[1] If property is subject to loan modification because of default or delinquency, additional restrictions may apply. See Program Report and Administrative Guidelines for details.

[2] For SCEIP, "residential property" is defined as single-family properties with 1-to-4 residential units; "commercial property" is all other property.

[3] If property owner has been in bankruptcy in the past three years, additional requirements may apply. See Program Report and Administrative Guidelines for details.

[4] Residential property value will be determined by a property valuation provided by Prime Valuation LLC, or submitting an appraisal by a licensed California real estate appraiser.

[5] Calculation: Sum of all lien balances against the property ÷ market value is less than or equal to 100%.

[6] Please see Program Report and Administrative Guidelines for details.

For Office Use Only	
[Date Stamp]	File No. _____
Received On: _____	By: _____

SECTION 2: Applicant Information

PROPERTY OWNER(S) LEGAL NAME(S) AS THEY APPEAR ON PROPERTY TAX RECORDS		
OWNER 1	LAST 4 DIGITS OF SSN OR TIN XXX-XX-	LIST ALL PARCEL #'S OWNED BY APPLICANT
OWNER 2	LAST 4 DIGITS OF SSN OR TIN XXX-XX-	LIST ALL PARCEL #'S OWNED BY APPLICANT
OWNER 3	LAST 4 DIGITS OF SSN OR TIN XXX-XX-	LIST ALL PARCEL #'S OWNED BY APPLICANT
OWNER 4	LAST 4 DIGITS OF SSN OR TIN XXX-XX-	LIST ALL PARCEL #'S OWNED BY APPLICANT

PROPERTY OWNER(S) TYPE (Check all that apply)

☐ Individual(s) / Joint Tenants / Common Property (Not in Trust) ☐ Corporation ☐ Limited Liability Company

☐ Trust / Trustees / Living Trust ☐ Partnership ☐ Other (Please specify)

PROPERTY OWNER CONTACT INFORMATION		
NAME	EMAIL ADDRESS	DAYTIME TELEPHONE NO

PHYSICAL PROPERTY ADDRESS AND ASSESSOR'S PARCEL NUMBER (Site of improvements)			
STREET ADDRESS	CITY	STATE CA	ZIP
ASSESSOR'S PARCEL NUMBER FOR SUBJECT PROPERTY			

MAILING ADDRESS (If different)			
MAILING ADDRESS	CITY	STATE	ZIP

SECTION 3: Property Information

PROPERTY TYPE (Check all that apply)

☐ Single Family Residential (1 to 4 units) ☐ Multi-Family Residential (5 or more units)

☐ Industrial ☐ Commercial

☐ Home Owner's Association (HOA/CCRs) ☐ Historic District

☐ Commercial NIACS Code _____

File No. _____

SECTION 4: Proposed Improvement Project Information

PROPOSED IMPROVEMENT PROJECT (Attach additional page(s) if necessary.)	
HOW IS PROPERTY CURRENTLY BEING HEATED? Select One	HOW IS THE PROPERTY CURRENTLY BEING COOLED? Select One

1. PROPOSED IMPROVEMENT MEASURE NAME		TYPE OF IMPROVEMENT (CHECK ONE) ☐ Water ☐ Energy ☐ Generation	
QUANTITY AND/OR SIZE. INDICATE # OF DOORS AND WINDOWS SEPARATELY		UNITS	
PROPOSED IMPROVEMENT MAKE AND MODEL		PROPOSED IMPROVEMENT SPECIFICATIONS, I.E., AFUE, U-RATING, R-RATING, ETC.	
PROPOSED IMPROVEMENT COST $	**(-) LESS REBATE** $	**(+) PLUS ESTIMATED PERMIT FEE** $	**(=) NET PROPOSED IMPROVEMENT COST** $

2. PROPOSED IMPROVEMENT MEASURE NAME		TYPE OF IMPROVEMENT (CHECK ONE) ☐ Water ☐ Energy ☐ Generation	
QUANTITY AND/OR SIZE. INDICATE # OF DOORS AND WINDOWS SEPARATELY		UNITS	
PROPOSED IMPROVEMENT MAKE AND MODEL		PROPOSED IMPROVEMENT SPECIFICATIONS, I.E., AFUE, U-RATING, R-RATING, ETC.	
PROPOSED IMPROVEMENT COST $	**(-) LESS REBATE** $	**(+) PLUS ESTIMATED PERMIT FEE** $	**(=) NET PROPOSED IMPROVEMENT COST** $

3. PROPOSED IMPROVEMENT MEASURE NAME		TYPE OF IMPROVEMENT (CHECK ONE) ☐ Water ☐ Energy ☐ Generation	
QUANTITY AND/OR SIZE. INDICATE # OF DOORS AND WINDOWS SEPARATELY		UNITS	
PROPOSED IMPROVEMENT MAKE AND MODEL		PROPOSED IMPROVEMENT SPECIFICATIONS, I.E., AFUE, U-RATING, R-RATING, ETC.	
PROPOSED IMPROVEMENT COST $	**(-) LESS REBATE** $	**(+) PLUS ESTIMATED PERMIT FEE** $	**(=) NET PROPOSED IMPROVEMENT COST** $

TOTAL PROJECT COSTS (Sums from above)			
PROPOSED IMPROVEMENT COST(S) $	**(-) LESS REBATE(S)** $	**(+) PLUS ESTIMATED PERMIT FEE(S)** $	**(=) NET PROPOSED IMPROVEMENT COST** $

File No. _____

PROGRAM COSTS/FEES

Property Valuation Cost ($12) – An appraisal tool used to determine the property market value of residential properties. Due when the application is submitted.

Title Cost ($50/$125) – Due when the application review is complete, immediately preceding Title search. (Requested when TILA is sent for signature.) The amount of the title cost is based on the requested financing amount. For financing requests less than $5000 the title cost is $50. For financing requests $5,000 to $499,999, the title cost is $125. Financing requests $500,000 and above require a full title search and title insurance. Contact SCEIP for estimate. For a second title search on the same APN within 180 days, the title cost is $30.

Recording Fee ($66) – for Assessment Lien documents and assessment contract. The amount is $66, which is set by state law and the County Recorder's Office. Due at contract signing.

Site Inspection Cost ($150) – Applicant may request interim payments for projects over $40,000. A finaled permit for that portion of work in which funds are requested will be required along with the Request for Disbursement form. If an interim payment is requested for a large project, an inspection by SCEIP staff to verify that 75% of materials are secured on the property will be required. There is a $150 fee for a SCEIP inspection, which is due at the time of inspection. Interest will accrue on the entire assessment amount at the time of the first interim payment.

Note: These fees and costs may not be included in the requested financing amount.

ITEMIZED ESTIMATED COST OF IMPROVEMENT(S) – DOCUMENTATION REQUIRED*

A.	Construction contract(s) (bid price for cost of materials and labor less any applicable rebates), excluding permit fees:	$ _____
B.	Contingency allowance - **OPTIONAL** [10% of above – single disbursement contracts under $40,000 only]:	$ _____
C.	Energy and water survey/analysis costs [Residential: highly recommended but not required to participate; Commercial: must obtain free PG&E or equivalent onsite energy analysis]:[7]	$ _____
D.	Professional services (Appraisal, drafting, engineering, project management and/or plan preparation costs):	$ _____
E.	☐ Permit Fee: _____ ☐ Permit included in bid	$ _____
	Total:	$ _____
	Requested Financing Amount:	$ _____

Minimum proposal amount (line A) is $2500.

REQUESTED ASSESSMENT REPAYMENT PERIOD

☐ 10 Years ☐ 20 Years	The minimum amount for a SCEIP Assessment Contract is $2,500. For assessments between $2,500 and $4,999, the term will be 10 years. Assessments $5,000 and above may be a term of 10 or 20 years.

[7] Solar projects require proof of 10% energy improvement on property prior to financing of solar installation through SCEIP. Documentation is required from participating contractor who provided the analysis. Rebates may be available for the analysis. Check with SCEIP staff.

File No. _____

Important Clarification

		Initial Here	
(1)	Work cannot begin until **Notice to Proceed** is issued.	_____	_____
(2)	Payment is disbursed after completion of work.	_____	_____
(3)	For single disbursement contracts under $40,000, one payment is issued, after all contractors' work is complete.	_____	_____
(4)	Property is subject to an annual administrative assessment for every contract adjusted annually based on the Department of Labor Consumer Price Index. It pays for costs associated with financing and bonding.	_____	_____
(5)	Prepayment is accepted for total remaining balance; however, no partial prepayment is allowed.	_____	_____
(6)	Accrued interest – Interest begins accruing on the bonded amount determined at disbursement (the first interim payment for multiple disbursement contracts).	_____	_____

***REQUIRED DOCUMENTATION**

- ☐ Organizational documents if Property Owner is not on title as an individual, *i.e., Trust Documents showing the 'powers of the trustee' to encumber the property.*
- ☐ Home Improvement Contract(s) or contractor's bid(s) or contractor's proposal(s), which include contractor's name and license number (unless self-installing). Please check our website for the list of participating contractors and basic qualification.. If your contractor is not on our list, please have him submit the required information to us.
- ☐ Copy(ies) of all rebate application(s) relating to the improvement(s).
- ☐ Statements, purchase orders, or other evidence of cost for items not covered by a Home Improvement contract or contractor's proposal or bid.
- ☐ Current mortgage statements, transaction histories, or other evidence that all mortgages or any other loans secured by the Property are current, including home equity loans and home equity lines of credit.
- ☐ Fannie Mae/Freddie Mac Instructions for Lenders – page 1 (please review and initial).
- ☐ Disclosure regarding Assessment Financing – page 11 (please complete and sign).
- ☐ State of California Fair Lending Notice – page 12 (please complete and sign).
- ☐ PG&E and/or Healdsburg Utility Authorization Form (please complete and sign).
- ☐ Commercial properties: Report from PG&E onsite energy evaluation.
- ☐ Commercial properties: Signed Lender Acknowledgement form from lender.
- ☐ Renewable generation project: authorized documentation showing 10% energy efficiency improvement.

ADDITIONAL DOCUMENTATION

SCEIP staff may request additional information and documentation they believe is necessary to prudently administer SCEIP. Such information and documentation could include without limitation additional comparison bids and information related to the market value of the Property.

SECTION 5: Costs and Finances

- All projects require permits. Fees are set and collected by the local building department.
- Onsite work may begin after **ALL** of the following acts have occurred: 1. Application approval; 2. Signing contract documents; and 3. Property owner receives a "Notice to Proceed."
- There is a $12 cost for property valuation provided by Prime Valuation, LLC.
- There is a title search cost Details are listed on page 6 of this application.
- There is a recording fee for the recordation of your contract and assessment lien. Recording fees are set by legislation and are listed on page 6 of this application.
- Assessment collection and processing costs will be added to the annual assessment on property tax bills. These costs are $40 for fiscal year 2011/2012, and will be adjusted in subsequent years for cost of living increases using the U.S. Department of Labor, Bureau of Labor Statistics, and Consumer Price Index for all urban consumers for the Northern California counties.
- Disbursement occurs each week. Requests for Disbursements received by 4:00 p.m. on the Wednesday before the disbursement day will be processed for payment the first County business day of the following week. Certain restrictions apply around holidays. Please contact SCEIP staff for further information.
- Interest begins accruing upon bonding following disbursement, which is usually the first business day of the following month.

SECTION 6: Declarations

By signing this Application, the undersigned hereby declares under penalty of perjury under the laws of the State of California all of the following:

1. I(we) am(are) current owner(s) of record of the property described herein (the "Property").
2. The Property is not currently involved in a bankruptcy proceeding.
3. I(we) are current on any mortgage or other loan secured by the Property.
4. I(we) and the Property meet the eligibility requirements listed in Section 1.
5. That (i) the information provided in this Application is true and correct as of the date set forth opposite my/our signature(s) on this Application and (ii) that I/we understand that any intentional or negligent misrepresentation(s) of the information contained in this Application may result in civil liability and/or criminal penalties including, but not limited to, fine or imprisonment or both and liability for monetary damages to the County of Sonoma, its agents, successors and assigns, insurers and any other person who may suffer any loss due to reliance upon any misrepresentation which I/we have made in this Application.
6. I(we) am(are) applying to participate in the Sonoma County Energy Independence Program. I(we) understand that I/we must execute an Assessment Contract and Implementation Agreement with the County of Sonoma in order to receive financing for the Improvements and I(we) have the authority, without the consent of any third party

which has not been previously obtained, to execute and deliver the Assessment Contract and Implementation Agreement, this Application, and the various documents and instruments referenced herein.

7. I(we) understand that the financing provided pursuant to the Assessment Contract will be repayable through an assessment levied against this Property. The Assessment Contract will specify the amount of the assessment and the assessment installments and the interest on the assessment to be collected on the tax bill for the Property each year. The assessment and the interest and any penalties thereon will constitute a lien against the Property until they are paid, even if I(we) sell the Property to another person. I(we) understand that assessment installments together with the interest on the assessment will be collected on my/our property tax bill in the same manner and at the same time as property taxes and will be subject to the same penalties, remedies, and lien priorities as for property taxes in the event of delinquency.

8. I(we) understand that if I(we) pay property taxes through an escrow account, it is my(our) responsibility to notify my(our) lender to adjust my/our monthly payments.

9. I(we) have reviewed any existing loan agreements and security instruments applicable to the Property, and verified that executing the Assessment Contract, receiving the financing for the Improvements, and consenting to the assessment levied against the Property will not constitute a default under any other agreement or security instrument which affects the Property or to which I(we) am(are) a party.

10. I(we) agree that the selection of any product(s), equipment, and measures referenced in this Application (the "Improvements"), the selection of any manufacturer(s), dealer(s), supplier(s), contractor(s) and installer(s), and the decision regarding the purchase, installation and ownership/maintenance of the Improvements is(are) my(our) sole responsibility and that I(we) have not relied upon any representations or recommendations of the County of Sonoma, its agents, representatives, assignees, or employees, in making such selection or decision, and that my manufacturer, dealer, supplier, contractor or installer of the Improvements is not an agent, employee, assignee or representative of the County of Sonoma.

11. I(we) understand that the County of Sonoma makes no warranty, whether express or implied, with respect to the choice, use or application of the Improvements, including without limitation, the implied warranties of merchantability and fitness for any particular purpose, use or application of the Improvements.

    I(we) agree that the County of Sonoma has no liability whatsoever concerning (i) the quality or safety of any Improvements, including their fitness for any purpose, (ii) the estimated energy savings produced by or performance of the Improvements, (iii) the workmanship of any third parties, (iv) the installation or use of the Improvements including, but not limited to, any effect on indoor pollutants, or (iv) any other matter with respect to the Sonoma County Energy Independence Program.

12. I(we) agree that any carbon credits attributable to the Improvements, if any, shall be held jointly by the County of Sonoma (on behalf of the Sonoma County Energy Independence Program), by the Sonoma County Water Agency and by the Sonoma County Transportation Authority.

13. I(we) understand that I(we) is(are) responsible for meeting all Sonoma County Energy Independence Program requirements and complying with all applicable Federal/State/County/City laws and the requirements of any agreement which affects the

Property or the use of the Property (such as homeowner's association requirements, if any).

14. I(we) understand that I(we) is(are) responsible for meeting a reduction of 10% of our overall energy use before (I)we are eligible for financing any renewable generation project (i.e., solar) on our property. If we have included financing in this application for a renewable generation project(s), I(we) further understand that if (I)we install a renewable project without having the authorized documentation issued by a qualified energy professional I (we) will not be eligible for SCEIP financing for the renewable project, even if I(we) have already installed the project. I(we) understand that without the authorized documentation issued by a qualified energy professional, we will be solely responsible for the cost of the renewable generation project and all related financial obligations to the installing building contractor.

Signed on this _____ day of _____, _____
Date *Month* *Year*

in the City of _____, State of California.
City

_____ _____
Property Owner Signature *Printed Name*

_____ _____
Property Owner Signature *Printed Name*

_____ _____
Property Owner Signature *Printed Name*

_____ _____
Property Owner Signature *Printed Name*

THE FEDERAL EQUAL CREDIT OPPORTUNITY ACT, WHICH MAY APPLY TO THIS TRANSACTION, PROHIBITS CREDITORS FROM DISCRIMINATING AGAINST CREDIT APPLICANTS ON THE BASIS OF RACE, COLOR, RELIGION, NATIONAL ORIGIN, SEX, MARITAL STATUS, AGE (PROVIDED THE APPLICANT HAS THE CAPACITY TO ENTER INTO A BINDING CONTRACT); BECAUSE ALL OR PART OF THE APPLICANT'S INCOME DERIVES FROM ANY PUBLIC ASSISTANCE PROGRAM; OR BECAUSE THE APPLICANT HAS IN GOOD FAITH EXERCISED ANY RIGHT UNDER THE CONSUMER CREDIT PROTECTION ACT. THE FEDERAL AGENCY THAT ADMINISTERS COMPLIANCE WITH THIS LAW CONCERNING THIS CREDITOR IS THE FEDERAL TRADE COMMISSION, EQUAL CREDIT OPPORTUNITY, WASHINGTON, DC 20580.

File No. _____

DISCLOSURE REGARDING ASSESSMENT FINANCING

The Sonoma County Energy Independence Program establishes the manner by which the County of Sonoma ("County") may finance, pursuant to Chapter 29 of Part 3 of Division 7 of the California Streets and Highways Code (commencing with Section 5898.10), the installation of distributed generation renewable energy sources or energy efficiency improvements that are permanently fixed to a property owner's real property ("Improvements"). Improvements will be financed pursuant to an assessment contract between the County and the property owner.

The financing of Improvements will be secured by and repayable through an assessment levied by the County against the owner's property (the "Property"). Each year until the assessment is paid off, assessment installments (including principal and interest) will be collected on the property tax bill for the Property in the same manner and at the same time as property taxes. Assessment installments will be subject to the same penalties, remedies (including foreclosure and sale of the property), and lien priorities as for property taxes in the event of delinquency.

The assessment and each installment thereof, and any interest and penalties thereon, will constitute a lien against the Property until paid even though prior to full payment the Property is conveyed to another person. An assessment lien will be recorded against the Property in the office of the County Recorder of the County of Sonoma upon execution of the assessment contract. Such lien will be paramount to all existing and future private liens against the Property, including mortgages, deeds of trust and other security instruments.

Before completing a Sonoma County Energy Independence Program Application, a property owner should carefully review any mortgage agreement(s) or other security instrument(s) which affect the Property or to which the property owner is a party. **ENTERING INTO A SONOMA COUNTY ENERGY INDEPENDENCE PROGRAM ASSESSMENT CONTRACT WITHOUT THE CONSENT OF THE OWNER'S EXISTING LENDER(S) COULD CONSTITUTE AN EVENT OF DEFAULT UNDER SUCH AGREEMENTS OR SECURITY INSTRUMENTS. DEFAULTING UNDER AN EXISTING AGREEMENT OR SECURITY INSTRUMENT COULD HAVE SERIOUS CONSEQUENCES TO THE PROPERTY OWNER, WHICH COULD INCLUDE THE ACCELERATION OF THE REPAYMENT OBLIGATIONS DUE UNDER SUCH AGREEMENT OR SECURITY INSTRUMENT. IN ADDITION, UPON RESALE OR REFINANCING OF THE PROPERTY, A LENDER MAY REQUIRE THAT THE ASSESSMENT LIEN BE PAID OFF PRIOR TO FUNDING ANY REFINANCING OR PURCHASE MONEY MORTGAGE.**

I(we) declare that (i) the owner has the authority, without the consent of any third party which has not been previously obtained, to execute and deliver the assessment contract, the Application, and the various documents and instruments referenced therein; and (ii) that executing the assessment contract, receiving financing for Improvements, and consenting to the assessment levied against the Property will not constitute a default under any other agreement or security instrument which affects the Property or to which the property owner is a party. **If you have any questions about any agreements or security instruments which affect the Property or to which you are a party or about your authority to execute the Sonoma County Energy Independence Program Application or enter into an assessment contract with the County without the prior consent of your existing lender(s), the County strongly encourages you to consult with your own legal counsel and your lender(s).** Sonoma County Energy Independence Program staff will not provide property owners with advice about existing agreements or security instruments.

ACKNOWLEDGEMENT OF RECEIPT

I have received a copy of the Disclosure Regarding Assessment Financing.

_____	_____
Property Owner Signature	*Printed Name*
_____	_____
Property Owner Signature	*Printed Name*
_____	_____
Property Owner Signature	*Printed Name*
_____	_____
Property Owner Signature	*Printed Name*

File No. _____

THE HOUSING FINANCIAL DISCRIMINATION ACT OF 1977

FAIR LENDING NOTICE

It is illegal to discriminate in the provision of or in the availability of financial assistance because of the consideration of:

1. Trends, characteristics or conditions in the neighborhood or geographic area surrounding a housing accommodation, unless the financial institution can demonstrate in the particular case that such consideration is required to avoid an unsafe and unsound business practice; or
2. Race, color, religion, sex, marital status, domestic partnership, national origin or ancestory.

It is illegal to consider the racial, ethnic, religious or national origin composition of a neighborhood or geographic area surrounding a housing accommodation or whether or not such composition is undergoing change, or is expected to undergo change, in appraising a housing accommodationor in determining whether or not, or under what terms and conditions, to provide financial assistance.

These provisions govern financial assistance for the purpose of the purchase, construction, rehabilitation or refinancing of one- to four-unit family residences occupied by the owner and for the purpose of the home improvement of any one- to four-unit family residence.

If you have any questions about your rights, or if you wish to file a complaint, contact the management of this financial institution or the Department of Real Estate at one of the following locations:

2550 Mariposa Mall, Suite 3070
Fresno, CA 93721-2273

2201 Broadway
P.O. Box 187000 (mailing address)
Sacramento, CA 95818-7000

320 W. 4th Street, Suite 350
Los Angeles, CA 90013-1105

1350 Front Street, Suite 3064
San Diego, CA 92101-3687

1515 Clay Street, Suite 702
Oakland, CA 94612-1462

ACKNOWLEDGEMENT OF RECEIPT

I (we) received a copy of this notice.

_____ *Property Owner Signature*	_____ *Printed Name*
_____ *Property Owner Signature*	_____ *Printed Name*
_____ *Property Owner Signature*	_____ *Printed Name*
_____ *Property Owner Signature*	_____ *Printed Name*

ENERGY
INDEPENDENCE

TRUTH IN LENDING DISCLOSURE STATEMENT

See reverse of form for definitions

APPLICANT NAME	PROGRAM NAME Sonoma County Energy Independence Program
PROPERTY ADDRESS	PROGRAM ADDRESS 404 Aviation Boulevard Santa Rosa, CA 95403
SCEIP FILE NO	**SIMPLE INTEREST RATE** 7.00%

ANNUAL PERCENTAGE RATE	**FINANCE CHARGE**	**AMOUNT FINANCED**	**TOTAL OF PAYMENTS**
The cost of your credit as a yearly rate.	The dollar amount the credit will cost you over the entire term of your assessment.	The amount of credit provided to you on your behalf.	The amount you will have paid after you have made all payments as scheduled.
E* %	E$	E$	E$

**E is defined as Estimate*

Your payment schedule will be:

NUMBER OF PAYMENTS	AMOUNT OF PAYMENTS*	WHEN PAYMENTS ARE DUE
	$	Payments are due in the same manner and in the same installments as the general taxes of the County on real property.

*All amounts and payments are estimated based on the maximum Assessment amount. After the final disbursement of Assessment proceeds a statement will be provided showing principal and payment amounts.

SECURITY	**APPLICABLE FEES**
The County will put a lien against the property entered into the property address field above.	See Reverse
LATE CHARGES	**PREPAYMENT**
Your payments will be collected in the same manner as your property taxes and will be subject to the same penalties, procedure, sale and lien priority in case of delinquency as applicable for property taxes.	If you prepay this assessment in full you may have to pay a premium of up to 3 percent under current market conditions. See Prepayment" on the back of this Statement for additional information.

See your contract documents for any additional information regarding non-payment, default, required repayment in full before scheduled date, and prepayment refunds and penalties. Written itemization of the Amount Financed and interest charges will be provided upon request.

I/We hereby acknowledge reading and receiving a complete copy of this disclosure. I/We understand there is no commitment for the Program to provide this financing and there is no obligation for me/us to accept this financing upon delivery or signing of this disclosure.

Applicant's Signature	*Date*	*Applicant's Signature*	*Date*
Applicant's Signature	*Date*	*Applicant's Signature*	*Date*

REV 11/23/2010

Sonoma County Energy Independence Program

Truth In Lending Disclosure Statement Definitions

Amount Financed

Amount of the assessment actually made available to a borrower, repayable according to terms of the assessment contract. It is equal to the Assessment Amount less any prepaid fees,

Amount of Payments

All amounts and payments are estimated based on the maximum assessment amount. After the final disbursement of assessment proceeds, a repayment schedule will be provided.

Annual Percentage Rate

Effective cost of credit in consumer loans and real estate loans expressed as a percentage interest rate. The annual percentage rate is the interest rate the borrower actually pays, including fees required in order to participate in the program.

Applicant Name

Property Owner requesting the contractual assessment.

Additional Fees

• Annual Assessment Fee[1]	$40.00
• Multiple Disbursement Fee Per Interim Disbursement	$150.00
• No Permit Required SCEIP Inspection Fee (varies by jurisdiction)	$67.00 - $150.00
• Recording Fee[2]	$66.00
• Title Costs – Initial	
◦ Financing requests less than $5,000	$50.00
◦ Financing requests $5,000 to $499,999	$125.00
◦ Financing requests $500,000 and above require title search and insurance. Contact SCEIP for estimate.	TBD
• Title Costs – Second project within 180 days	$30.00
• All projects subject to local jurisdiction building permit fees	TBD

Finance Charge

The Assessee's total cost of assessment, including interest, fees, and prepaid interest. Under the Truth in Lending Act, the finance charge must be disclosed as the total dollar cost of credit. Contrast with ANNUAL PERCENTAGE RATE, which states the cost of credit as an annualized rate. This is the amount the Assessee will pay over the entire term of the assessment. This amount will change if the assessment is paid off early or the initial amount of the assessment is less than the amount listed in item #6, Amount Financed.

The finance charge does not include late payment fees or annual fees.

Itemization

This is a line item breakdown of the amount of your assessment.

Late Charges

Your payments will be collected in the same manner as your property taxes and will be subject to the same penalties, procedure, sale, and lien priority in case of delinquency as applicable for property taxes.

Number of Payments

This is the number of installment payments requested by the applicant.

Prepayment

This assessment may be prepaid in at any time, but may incur up to a three percent premium. Currently, there is no premium, but it may be imposed by future bond investors in order to allow you to prepay this assessment in full. Available payoff dates are at the end of each month except for March and September when payoff dates are the 10th of the following month. Please call for a correct payoff quote prior to sending any payment. Partial prepayments are not permitted except at the discretion of the County in the case multiple disbursement contracts, and only from remaining unspent assessment proceeds.

Program Name

Entity that coordinates with the Applicant and Sonoma County Tax Collector to assign the assessment to the property.

SCEIP File No

Sonoma County Energy Independence Program File number assigned to the application.

Security

The real property that will be pledged as collateral for the assessment.

Simple Interest Rate

Interest rate calculation based on the original principal amount.

Total of Payments

The Total of Payments is the amount you will have paid after making all payments as scheduled.

When Payments are Due

Payments are payable in the same manner and in the same installments as the general taxes of the County on real property payable.

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[1] The Annual Administrative Assessment shall not exceed $40.00 in fiscal year 2009-2010 of the assessment, and shall thereafter be adjusted annually for cost of living based on the U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index for all urban consumers for the Northern California Counties. The Annual Assessment charge is calculated in the Annual Percentage Rate (APR).

[2] The Recording Fee for the Assessment Lien documents and Assessment Contract is set by State law and the County Recorders Office and is updated annually.

SCEIP File No: _____

ENERGY
INDEPENDENCE

NOTICE OF RIGHT TO CANCEL

Your Right to Cancel

You are entering into an Assessment Contract with the County of Sonoma for financing under the Sonoma County Energy Independence Program ("SCEIP") that will result in a lien on the property at _____. You have a legal right under federal law to cancel this transaction, without cost, within three business days from whichever of the following events occurs last:

(1) The date on which the Assessment Contract has been signed by both you and the County of Sonoma or its representative, which date is _____; or

(2) The date you received your Truth in Lending disclosure; or

(3) The date you received this Notice of Right to Cancel.

If you cancel the transaction, the lien is also discharged. Within 20 calendar days after we receive a notice of cancellation, we must take the steps necessary to reflect the fact that the lien on your property has been discharged, and we must return to you any money you have given to SCEIP in connection with your application for assessment financing.

You may keep any money we have given you until we have done the things mentioned above, but you must then offer to return the money. Money must be returned to the address below. If we do not take possession of the money within 20 calendar days of your offer, you may keep it without further obligation.

Acknowledgement of Receipt

I/We hereby acknowledge reading and receiving a complete copy of this Notice of Right to Cancel.

_____ _____

Applicant's Signature *Date*

How to Cancel

If you decide to cancel this transaction, you must do so by notifying SCEIP in writing at:

- Sonoma County Energy Independence Program
  404 Aviation Boulevard
  Santa Rosa, CA 95403
  Fax: (707) 524-3769

You may use any written statement that is signed and dated by you and states your intention to cancel, or you may use this notice by dating and signing below. Keep one copy of this notice because it contains important information about your rights.

If you cancel by mail, fax or email, you must send the notice no later than midnight of the latest of the three events listed above. If you send or deliver your written notice to cancel some other way, it must be delivered to the above address no later than that time.

I WISH TO CANCEL

_____ _____

Applicant's Signature *Date*

EXHIBIT C

NREL National Renewable Energy Laboratory
Innovation for Our Energy Future
A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

A New Market Paradigm for Zero-Energy Homes: The Comparative San Diego Case Study

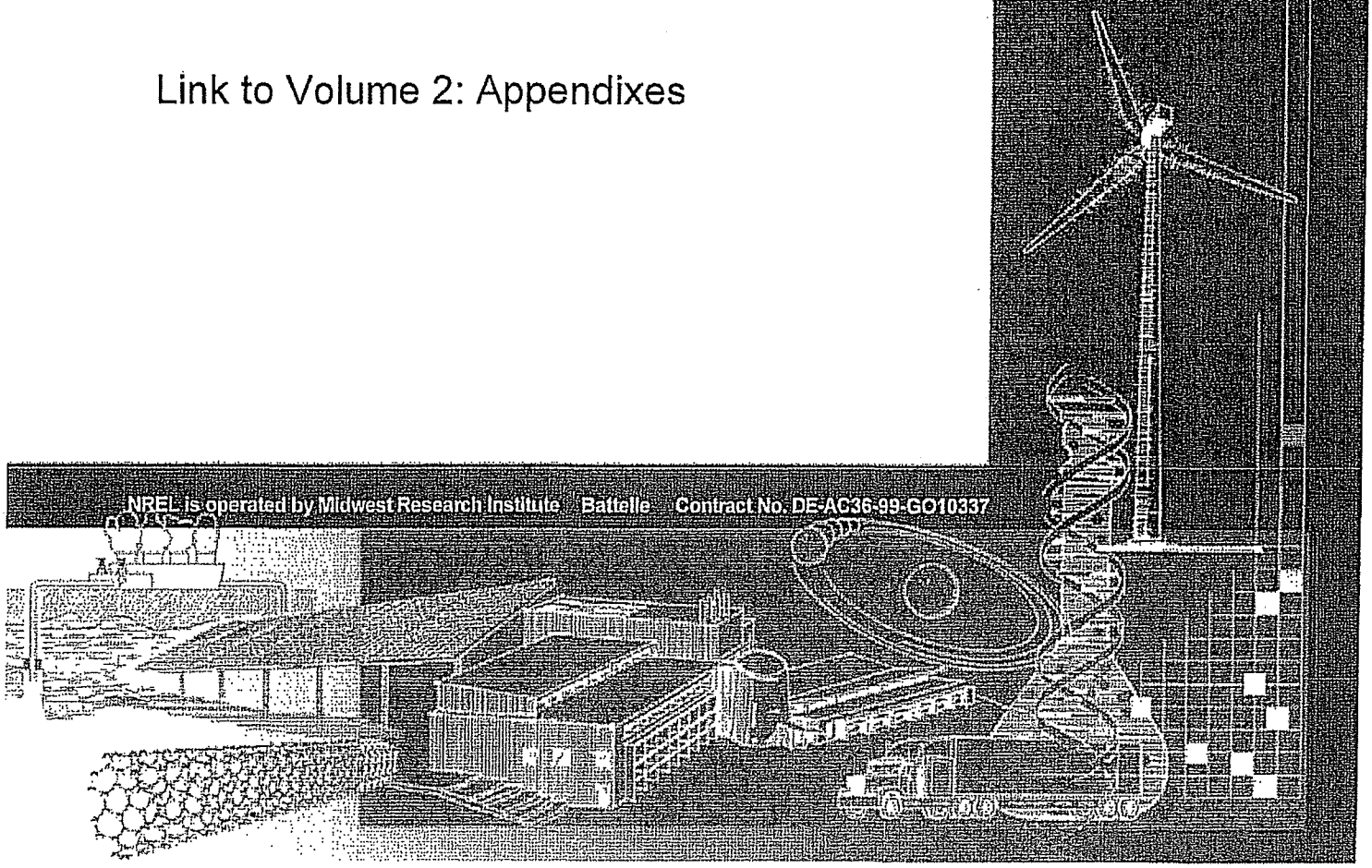
Volume 1 of 2

B.C. Farhar
National Renewable Energy Laboratory

T.C. Coburn
Abilene Christian University

Technical Report
NREL/TP-550-38304-01
December 2006

Link to Volume 2: Appendixes



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A New Market Paradigm for Zero-Energy Homes: The Comparative San Diego Case Study

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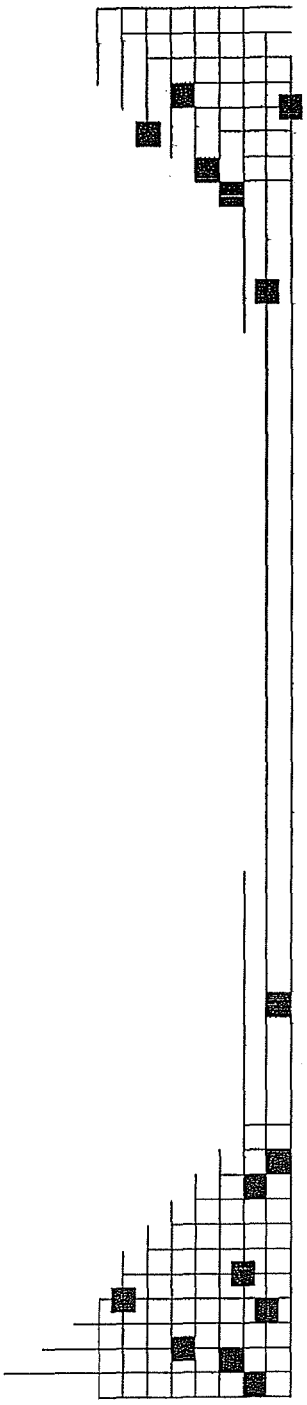

National Renewable Energy Laboratory
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Contract No. DE-AC36-99-GO10337

Executive Summary

Introduction and Background

"It's good for society."

– This and other quotes are from comments made by owners in the SheaHomes Scripps Highlands communities.

In April 2001, SheaHomes began to offer high-performance homes at Scripps Highlands in San Diego, California. This was the first such offering in the United States by a production builder. The 306 homes, sold by November 2003, were highly energy efficient; 293 had solar water heating systems; and 120 had photovoltaic (PV) systems.

The National Renewable Energy Laboratory (NREL) used a diffusion-of-innovations theoretical perspective to follow this development over time. The study focused on the builder experience, market response to high-performance homes, increases in home values over time, and the consumption and cost of electricity and gas in the high-performance and adjacent comparison homes.

We began our work by meeting with a project advisory group to define key research questions. During the first, qualitative phase of the study, we conducted numerous interviews of executives and staff of SheaHomes, organizations partnering with the builder, and other interested parties. Field work was conducted at the SheaHomes community with early buyers and lost lookers. Researchers collected background information on the home sales processes. Qualitative interviews focused on the homeowners' reasons for purchase and their perceptions of the energy features of their new homes. In this early phase, a total of 43 respondents in 25 households were interviewed; the information obtained was used to formulate questions for a more extensive survey of all homeowners.

We also selected a comparison community of 103 homes built by a different builder of similar vintage, size, and price adjacent to San Angelo and Tiempo. Although they were built to Title 24 building codes, thus providing more energy efficiency than conventional building codes in other states, the comparison homes were offered with no special energy or solar features standard.

The quantitative phase consisted of a comprehensive mail survey and detailed statistical analysis of the responses from SheaHomes and comparison homeowners. Questionnaires were mailed early in 2004 to all homebuyers. The overall survey response rate was 63% (65% from the SheaHomes communities and 56% from the comparison community). The survey addressed perceptions and preferences of the new homebuyers and the roles, if any, that energy played in their home purchase decisions. The survey also examined homebuyer satisfaction, willingness to pay for solar PV, preferences about energy policies, experiences with the homes, aesthetics of solar PV, satisfaction with utilities, and demographics, including environmentalism and innovativeness.

Respondents were asked to sign release forms for SDG&E to provide data on electricity and natural gas consumption and costs. The utility company provided the data to NREL, which performed analyses to determine if statistically significant differences in energy consumption and

energy costs can be attributed to the energy efficiency and solar features of the high-performance homes. These analyses controlled for an annual usage cycle, climate, square footage, number of occupants, and other variables. This unique research opportunity gave us the chance to put conventional wisdom about ZEH markets to the test; the detailed findings from our study are contained in this comprehensive 800-page report.

Home Sales Prices

High-performance homes are competitive on the market. Based on actual sales data, per square foot, they sold for 9.2% less than comparison homes of the same vintage, on average. This difference, though small, is statistically significant. When house size is controlled for, the difference remains. Thus, even when controlling for the fact that housing prices per square foot decrease with house size, we find that the SheaHomes were competitively priced.

Uptake of Optional PV Systems

> *"It's best to integrate the solar electric system into the entire home purchase rather than having it offered as an option in a piecemeal way. It should all be rolled into the overall price."*

Ultimately, 120 of the 306 SheaHomes were sold with some sort of PV system. Hence, 39% were sold with PV systems and 61% were not. However, only 260 homes were PV-eligible; hence, 46% of these were sold with PV systems. Clearly, the uptake on optional PV equipment was not as strong as it might have been. A total of only 12% of all PV-eligible homes were sold with PV systems optionally. Most of the PV systems sold came standard.

> *"We feel the builders know what they are doing, so if they offer the solar as part of the package, there must be a reason."*

However, we believe the lackluster sales of optional PV systems was the result of sales staff failure to offer the optional PV systems to buyers of PV-eligible homes. In fact, our data show that a majority (56%) of those who could have purchased optional PV systems were *not told* about the option. Thus, *the uptake rate is not 12%, but 44% of those actually offered the PV systems.* Homebuyers relied heavily on sales staff for information about PV systems, and staff were more concerned about closing home sales and less focused on sales of PV systems that might complicate the deal. Staff received no extra compensation for sales of PV systems.

Who Are These Homebuyers?

The buyers of high-performance homes and the buyers of new conventional homes share the same characteristics. SheaHomes and comparison homebuyers brought virtually identical attributes to their home purchase decisions, such as demographics, environmental attitudes, and early adopter characteristics.

As expected, residents of both communities mostly represent upper-middle class married couples with children, or mature couples. They are relatively affluent with well-paying occupations. Fifteen percent more of the SheaHomes owners (19%) than of the comparison owners (4%) enjoy an annual income of more than $200,000. Yet, because SheaHomes' sales prices were competitive, higher income would not have influenced their decisions to buy there. No differences between SheaHomes and comparison homebuyers are found in results on measures of early adopter characteristics or environmentalism.

Three-quarters of the buyers visited both the SheaHomes and comparison communities when they were shopping for new homes. However, neither group was well informed about home energy features, although buyers of SheaHomes knew a bit more at the time of purchase. A majority of the comparison buyers were unaware that they featured energy efficiency and solar energy, even though they may have visited SheaHomes.

Variables on which the types of homeowners differ were by and large those *affected by their experiences in living in their new homes* (survey data were collected after owners had lived in their new homes for at least six months). For example, six in ten of SheaHomes owners agree that solar water heating systems are cost effective, and half of SheaHomes owners agree that solar PV systems are cost effective. The corresponding percentages of comparison homebuyers are 40% and 36%, respectively.

Despite some difficulties with interconnectivity issues, owners of SheaHomes with PV systems have more positive attitudes toward SDG&E than other homeowners. These differences are significant. A majority of PV homeowners are pleased with SDG&E's billing processes. Similarly, almost one-third of PV owners believed that electricity rates had come down since they moved in, compared with 18% of SheaHomes owners without PV systems.

> *"We isolate things to see what the electricity hogs are. We're already more energy conscious because of the feedback device."*

It is not the qualities the homebuyers brought to the home purchase decision, but rather *the experience of PV ownership that changes attitudes and perceptions.* It also seems to change energy behavior. Living in highly energy efficient homes with solar water heating and PV systems promotes increased familiarity with and interest in those systems, which ultimately leads to heightened awareness of household energy practices. The behavioral interaction of consumers with PV technology based on the digital display of kWh production and consumption—and to some extent the electric meter—provides feedback that seems to affect homeowner energy behavior. Feedback may be significant in bringing about behavioral changes that optimize energy and cost savings. To a limited degree, the PV owners also seem more sensitive than others to savings from solar water heating systems, even though these have no feedback devices.

Aesthetics and Resale Value

Regarding aesthetics—

"Huh?"

"Satellite dishes are more offensive."

Neither qualitative nor quantitative data identified aesthetics as barriers to purchase of homes with solar panels. However, because we primarily studied homeowners who bought such homes, we cannot conclude that no one objects to the aesthetics of solar panels. It seems fair to conclude that the new homebuying market is large enough that it does not matter if some people object; in fact, home sales at Scripps Highlands were brisk.

Similarly, based on our data, any concerns about solar panels diminishing resale value appear unwarranted. In the first 3.5 years, 13% of the comparison homes were resold compared with 5% of the SheaHomes, suggesting a more rapid turnover of comparison homes. SheaHomes experienced a mean dollar gain of 55.4% for a mean ownership length of 22.5 months. Comparison homes experienced a mean dollar gain of 44.7% for a mean ownership length of 28.1 months. The mean dollar gain per month owned was $14,500 for SheaHomes and $9,300 for comparison homes.

Home Purchase Decisions

The most important reasons for purchase for both categories of buyers were the home's location in a safe and secure quality neighborhood, the overall home value, and the investment potential. The relative rankings of reasons for purchase were the same for both categories of homebuyers. Concerns about the San Diego 2001 electricity crisis did not influence home purchase decisions. Energy was not an important factor in the purchase decisions of most of the study's new homebuyers. The reputation of the builder was more important to SheaHomes than to comparison buyers. Buyers who were more concerned about their residential energy consumption were more likely to buy SheaHomes than comparison homes. Every home feature mentioned in our study had a higher average importance rating for those who did not purchase PV homes than for those who did, suggesting that home characteristics other than energy features were more important to those not purchasing homes with PV systems.

The findings on willingness to pay (WTP) more for PV systems suggest that $5,000 may be a threshold for 1.2 PV systems. More than one-third of non-PV-purchasing homebuyers indicate a WTP at least $5,000 more for PV systems that could replace 50% to 70% of their electricity needs. This level of savings would require a larger PV system. SheaHomes buyers who upgraded from 1.2 to 2.4 PV systems paid an additional $4,000; those who purchased optional 1.2 PV systems paid $6,000 (later raised to $7,000). Those who purchased optional 2.4 PV systems paid $10,000 (later raised to $11,000). Reasons for not purchasing PV systems tend to center around the expense. Subsidies and amortization would be required to permit installation of larger 2.4 to 3+ PV systems that would be needed to reduce electricity costs by 60% to 70%.

Satisfaction

"When people come to visit, the first thing we do is show them the solar equipment."

Most buyers are satisfied with their new homes, but SheaHomes buyers, and especially buyers of homes with PV systems, are more satisfied than are comparison buyers. A significantly higher percentage of SheaHomes owners than owners of comparison homes (77% versus 67%) indicate they would buy the same houses again. Although this would not be the only factor affecting satisfaction, the comparison homeowners report significantly higher monthly utility bills than do the SheaHomes owners. Both sets of homeowners find their homes comfortable, but comparison buyers pay higher utility costs to maintain their comfort levels. Owners of SheaHomes believe their homes are energy efficient.

By owners' estimates, living in PV homes has resulted in significantly lower utility bills than those reported by the rest of the homebuyers. Two-thirds of PV owners have bragged to others about their utility bills, compared to one-quarter of owners without PV. A majority of PV owners indicate their expectations for utility bills have been met, compared with less than one-third of other SheaHomes owners.

"We brag about our windows."

Three dimensions of advantages of PV ownership result from factor analysis. The first of these is "altruistic" benefits (such as helping to reduce global warming, helping the local economy, benefitting future generations, and helping to improve local air quality). The second is the financial advantage (such as reduced electricity bills, free electricity once the system is paid for, selling electricity back to SDG&E, and increasing the home's resale value). Finally, personal satisfaction includes increased self-sufficiency, being technologically innovative, and feeling good about owning the home.

Policy Preferences

"Solar electricity should be available and affordable on all housing."

SheaHomes and comparison owners agreed on energy efficiency and solar energy policy preferences. For example, 92% of both sets of homeowners agree or strongly agree that "builders should build very energy-efficient homes if they cost less per month to own and operate." Eighty-five percent of SheaHomes and 81% of comparison buyers agree or strongly agree that "the federal government should support research on highly energy-efficient homes that produce all the energy they use." Interestingly, majorities of both sets of homeowners agree that solar water heating and solar PV systems are desirable innovations for new homes.

Are Energy and Costs Saved?

SheaHomes advertised that its homes, incorporating "the latest in solar electric home power generation, solar water heating, and energy-efficiency technology," would enable homeowners to reduce their utility bills by 30% to 50% over conventionally built homes. *The original SheaHomes concept has been validated by our utility analysis.* Among the homes studied, SheaHomes consume less electricity and gas, on average, than adjacent comparison homes. Similarly, SheaHomes households incur lower utility costs, on average, than comparison households. For example, the combined average monthly total utility bill for homes with 2.4 PV systems is 54% lower than for comparison homes, a result that is statistically significant.

A New Market Paradigm

The value of our study does not lie in describing the motivations of recent new homebuyers, but rather in suggesting a conceptually fresh alternative paradigm for the building and marketing of new ZEHs. When this paradigm is used, builders, new homebuyers, and utility companies will benefit. When appropriately applied to business practice and public policy, this new paradigm will help builders create the sustainable communities so necessary for our well-being and that of future generations.

Conventional wisdom on the markets for ZEHs, relying on a diffusion-of-innovations tradition, holds that ZEHs will appeal only to niche early-adopter markets. It posits that ZEHs cost more to build and therefore are more expensive to buy than conventional homes. It would follow that production builders should offer them optionally to buyers with unique motivations, such as environmentalism. In this view, ZEH aesthetics (in particular, the solar PV panels) are often considered barriers to most mainstream homebuyers, and as impediments to resale, negatively affecting home values. Conventional wisdom also assumes that mainstream homebuyers are motivated by economic payback on an incremental financial investment for zero-energy features for which they have opted. Homebuyers' satisfaction, then, is considered contingent on the perceived payback of energy features.

Our results suggest a new market paradigm for ZEHs that appears to stand conventional wisdom on its head. This paradigm, though it originates from the San Diego case study, may be useful elsewhere in California and in the rest of the country, and, indeed, internationally. The table below captures some of the notions that we have termed conventional wisdom and summarize the new market paradigm along these same dimensions.

The results of this case study suggest that the markets for new housing are essentially equivalent to the markets for ZEHs standard, assuming a policy frame that provides subsidies and builder pricing similar to those in effect when San Angelo and Tiempo were built and sold. However, this does not mean that the diffusion-of-innovations approach is irrelevant to the widespread acceptance of ZEHs. Rather, the early adopters are the *builders*, *utility companies*, and *policy-makers* whose adoption of ZEHs will make these homes available standard to many willing homebuyers. For us to benefit from ZEHs, the innovative building practices for which

SheaHomes has led the way and the ZEH-supportive policies for which California is becoming increasingly famous are the innovations that must diffuse.

Market Paradigms for Zero-Energy Homes

Attributes	Conventional Wisdom	New Market Paradigm
Sales Prices	ZEHs cost more to build than other homes and are more expensive on the market.	Quality upscale high-performance homes with market appeal can be built by production builders and sold competitively and profitably, especially where subsidies are in place.
Uptake	In new developments, builders should offer ZEHs optionally, and only a few will be sold.	Builders should offer ZEHs standard; most buyers will buy them. In addition, the pace of sales may well be accelerated over that of conventional homes.
Homebuyers	Only innovators and early adopters will buy ZEHs (a very small percentage of the market).	High-performance homebuyers are ordinary buyers of new production homes in their price ranges; they have no special demographic attributes; their environmentalism and early-adopter characteristics are no different from those of other buyers; some may, in fact, be "unwitting adopters."
Aesthetics	Aesthetics are major barriers to ZEH purchase for most buyers and negatively affect resale value.	Enough buyers are unconcerned about aesthetics that they purchase homes with solar panels, at least in a seller's market, at an accelerated pace. Resale homes with solar panels have higher value than comparison homes.
Home Purchase Decisions	Other than early adopters, buyers of ZEHs would be motivated by economic payback for an incremental financial investment for which they have opted.	ZEH buyers, for whom energy features are only "icing on the cake," may be *unaware* of any potential additional financial investment if the costs of energy systems are built into the homes' sales prices and into their mortgages. In fact, some buyers are "unwitting adopters." However, buyers *are* aware of their substantial benefits from reduced utility bills. In this model, financial incentives (e.g., rebates) go to the builder, although buyers may receive income tax credits or renewable energy credits.
Satisfaction	Homebuyer satisfaction is contingent on perceived payback of energy features.	Owners of high-performance homes with PV systems perceive three major kinds of benefits: (1) altruistic, (2) financial, and (3) personal satisfaction. These owners appear to become increasingly satisfied over time as they receive feedback from their systems, modify their behavior, and observe (and brag about) their utility bills.

Recommendations and Concluding Remarks

"We wanted to get the house because the system was already there. We didn't have to decide about it. We're glad it's here. We're lucky to have the PV."

A recommendation from our findings is that builders should offer ZEHs standard (rather than optional). Highly efficient, and with solar water heating, these homes should have at least 2.4 PV systems and should include digital feedback displays showing consumption and production of electricity. Transaction costs are too high when homes and solar energy systems are sold separately, and homebuyers have difficulty determining the value of solar features as home options when juxtaposed with other options. Our research suggests that from a marketing perspective using this standard-package approach when offering homes with specific energy packages is simply more effective.

In conclusion, this study is replete with findings that support the rapid development of high-performance homes with PV systems, near-ZEHs, and ZEHs. Once offered standard, the costs of these homes to the builder appear to be manageable, the product provides differentiation on the market, and ordinary homebuyers want to buy these homes. Once they live in them, homeowners become even more enthusiastic. Policies that support the deployment of ZEHs, such as net-metering legislation, simplified interconnectivity agreements, building codes and standards, utility rebates, and subsidies for solar water heating and PV systems, will be rewarded by rapid diffusion of an idea whose time has come.

Through its pioneering work in building the nation's first high-performance home development at the highly desirable Scripps Highlands location from 2001 through 2003, SheaHomes has provided a tremendous service to its homebuyers, San Diego, the California and U.S. housing industry, and energy professionals everywhere. The upscale homes it built are very energy efficient with solar water heating systems. Because SheaHomes offered one-third of its homes with solar photovoltaic (PV) systems standard, and left solar PV adoption for the rest up to the homebuyers, a rare opportunity for insight into the behavior of the ZEH market emerged.

Chapter 5
Increases in Property Values

Introduction

Chapter Highlights

- SheaHomes and comparison homes increased markedly in value (as of 2/7/05).
- SheaHomes had been held an average 22.5 months and comparison homes 28.1 months before resale.
- Resale prices for 29 resold homes show that the increase in value for SheaHomes averaged 55.4% and for the comparison homes 44.7%.
- The mean gain in property value per month was $14,492 for SheaHomes and $9,301 for comparison homes.

One research question in this study relates to whether high-performance homes hold their value over time or, indeed, if they provide financial advantages to their owners at the time of resale. During the years between 2002 to 2004, housing prices in the San Diego area were increasing rapidly. For example, an Internet search in March 2005 showed that, between October 2003 and April 2004, average housing prices in San Diego County increased 14.4%.

Farhar, Coburn, and Murphy (2004) reported that the resale property value of both categories of homes had increased by January 2004 (based on a small sample of 10 SheaHomes and six comparison homes). Property values had increased more for the SheaHomes than the comparison homes.

Findings

Resale data were checked again on February 7, 2005. Table 9 shows the original and resale prices for the two developments as of that date. The same pattern of results continued to hold. Twenty-nine homes had been resold by that date—15 (approximately 5%) of the SheaHomes and 13 (approximately 13%) of the comparison homes.

The SheaHomes and the comparison homes have increased markedly in value since they were originally purchased but, based on the selling prices of this group of 29 resold homes, the SheaHomes have increased in value more. The increase in value for the SheaHomes averaged $306,510 (55.4%) whereas the increase in value for the comparison homes averaged $262,968 (44.7%). Thus, the resold SheaHomes have increased in value 14% more than the comparison homes on average.[1]

The data in Table 9 show that the homes in the two communities were held, on average, a comparable length of time before resale, although homes in the comparison community were held somewhat longer (a mean of 22.5 months by the SheaHomes owners and 28.1 months by the comparison owners). More strikingly, the data show that the mean gain in property value per month owned was $14,492 for the SheaHomes and $9,301 for the comparison homes, a gain 36%

[1]These calculations do not take into account the fact that SheaHomes originally sold for $10/ft^2 less than the comparison homes.

higher for SheaHomes than comparison homes. The mean gain in property value per square foot per month owned was $4.97 for the SheaHomes and $3.23 for the comparison community homes. The mean percentage gain in property value per square foot was .019 for the SheaHomes and .016 for the comparison homes.

The greatest single gain in value was $446,410 for a home in the SheaHomes communities with a PV system owned for 26.9 months (a 79% increase in value). In comparison, the single largest gain for a home in the comparison community was $378,769 for a home owned for 40.2 months (a 61% increase).

Data are not available in this study for many factors that can affect property values. However, the study does include information about the energy features of the resold SheaHomes. The average gains in value for SheaHomes with PV systems are higher than for those without PV systems (see Table 10). The average dollar gain per month of SheaHomes with PV installations was $16,302, whereas the average dollar gain for SheaHomes without PV installations was $13,834; PV homes appreciated 15% more per month. The average gain per month per square foot for PV homes was $5.71, and for homes without PV systems it was $4.70. The SheaHomes with PV systems appreciated 6% more overall than did SheaHomes without PV systems.

Of the 103 comparison homes, 13, or 12.6% (counting the home sold twice) were resold by 2/7/05. Of the 306 SheaHomes, 15, or 4.9% were resold by 2/7/05. This more rapid turnover of comparison homes compared with that of SheaHomes was unexpected. There is no reason to believe that the kinds of life changes that might cause homeowners to put their homes on the market—including changes in employment or financial situations, marital status, or health—would occur more frequently in one home development rather than the other. Thus, it may be reasonable to speculate that the turnover rate constitutes more evidence that the comparison homeowners are somewhat less satisfied with their homes (as other data in this study indicate) than the SheaHomes owners.

Based on this analysis of the property values of resold homes at Scripps Highlands, it seems fair to conclude that, at a minimum, high-performance homes not only hold their value but increase their value at a faster rate than do conventional homes.

Table 9. Comparisons of Gains in Property Values and Length of Ownership for Homes in the SheaHomes and Comparison Developments (as of 2/7/05)

Variable	Homes in SheaHomes Communities (n=15)	Homes in the Comparison Community (n=12)*
Original price	Range: $482,900–$701,184 Mean: $556,344	Range: $538,522–$711,887 Mean: $598,028
Resale price	Range: $680,000–$1,100,000 Mean: $862,853	Range: $760,000–$995,900 Mean: $862,590
Home size (in ft^2)	Range: 2,222–3,678 Mean: 2,961.8	Range: 2,486–3,502 Mean: 2,975.2
Mean length of ownership before resale	22.5 mos.	28.1 mos.
Length of ownership (range)	9.9–43.9 mos.	17–40.2 mos.
Mean $ gain in property value	$306,510**	$262,968
Mean % gain in property value	55.4%	44.7%
Range of percentage $ gain in property value	High = 80.5% (ineligible, owned 24.6 mos.) Low = 30.5% (main, owned 14. 9 mos.)	High = 69% (owned 39.7 mos.) Low = 21.5% (owned 22.2 mos.)
Range of $ gain	High = $446,410 (PV, owned 26.9 mos.) Low = $190,354 (main, owned 14.9 mos.)	High = $378,769 (owned 40.2 mos.) Low = $153,113 (owned 22.2 mos.)
Mean $ gain per mo. owned	$14,492	$9,301
Mean $ gain in property value per ft^2	$104.70	$92.99
Mean $ gain in property value per ft^2 per mo.	$4.97	$3.23
Mean % gain in property value per ft^2	.019	.016

*An additional home was resold twice by 2/7/05 but was excluded for purposes of this analysis
**The mean gain for SheaHomes was 16.6% more than for homes in the comparison community

Table 10. Comparisons of Gains in Property Values and Length of Ownership for SheaHomes with and without PV Systems (as of 2/7/05)

Attribute	Homes with PV Systems (n=4)	Homes without PV Systems (n=11)
Original price	Range: $505,700–$636,730 Mean: $564,329	Range: $482,900–$624,646 Mean: $553,440
Resale price	Range: $739,000–$1,010,000 Mean: $884,950	Range: $769,500–$1,100,000 Mean: $854,818
Home size (in ft^2)	Range: 2,584–3,165 Mean: 2,868.3	Range: 2,222–3,678 Mean: 2,995.8
Mean length of ownership before resale	20.3 mos.	23.2 mos.
Length of ownership (range)	13.6–26.9 mos.	9.9–43.9 mos.
Mean $ gain in property value	$320,621*	$301,378
Mean % gain in property value	56.8%	54.5%
Range of percentage $ gain in property value	High = 79.2% (owned 26.9 mos.) Low = 46.1% (owned 23 mos.)	High = 80.5% (ineligible home, owned 24.6 mos.) Low = 30.5% (main home, owned 14.9 mos.)
Range of $ gain	High = $446,410 (owned 26.9 mos.) Low = $233,300 (owned 17.9 mos.)	High = $425,100 (ineligible home, owned 43.9 mos.) Low = $190,354 (main home, owned 14.9 mos.)
Mean $ gain per mo. owned	$16,302	$13,834
Mean $ gain in property value per ft^2	$111.77	$102.13
Mean $ gain in property value per ft^2 per mo.	$5.71	$4.70
Mean % gain in property value per ft^2	.02	.019

*The mean gain for homes with PV systems was 6.4% more than for homes without PV systems

Chapter 23
Findings, Conclusions, and Discussion

Introduction

This study was a natural field experiment. It was an empirical and statistical approach to the data and did not involve engineering or economic analysis. The research situation resulting in the findings in this report is unique. We were able to work closely with the SheaHomes staff, and to locate a comparison community adjacent to the high-performance homes that matched the San Angelo and Tiempo homes well. Before the research began, there was a good deal of media attention to and public interest in the high-performance homes project. Even though the SheaHomes owners were fatigued by contacts from reporters and other researchers, they were generous with their time in granting lengthy qualitative interviews and in completing complex questionnaires. The comparison homebuyers were almost equally cooperative and generous with their time. SDG&E staff were also patient and helpful in providing utility data and background information on questions related to utility billing, interconnectivity issues, and net metering. Research at other sites might not be conducted in such an ideal situation.

Because the study's findings are highlighted and summarized in the executive summary and in each chapter, this chapter will not focus on them. Instead, this chapter emphasizes discussion of the meanings and implications of the findings. Offering conclusions on such a substantial study is a daunting task; thus, not every possible conclusion is included here. The focus is on the most important implications that we believe should be highlighted.

The conclusions are discussed in several sections covering topics as follows: who the homebuyers are, their reasons for purchase, and their satisfaction with their homes; PV owners' characteristics, decision-making, satisfaction, information levels, and perceived benefits of PV ownership; aspects of utility consumption and cost including the delivery of high-performance homes on their promise of saving energy costs, the interactive effect between technology and behavior, and modeling utility consumption and cost; and the business aspects of high-performance homes, including their cost relative to other homes, the benefits and costs to the builder, the role of the builder staff, the SheaHomes discontinuance decision, and the value of resold high-performance homes.

Who Are These Homebuyers?

SheaHomes and comparison homebuyers are very much the same. They comprise a homogeneous population of new homebuyers looking for upscale homes in north San Diego. The similarities between these groups as they went through their home search process far outweigh any differences detected. The two categories of homebuyers are similar in their reasons to purchase, designation of energy as a low priority reason for purchase, satisfaction with the sales staff, and satisfaction with their homes' comfort. Respondents are male and female heads-of-household, although 56% are male. They are original owners of the new homes and 90% had

previously owned homes. Three-quarters of the respondents are between 25 and 50 years of age, and two-thirds have families. They are highly educated with professional, business, and scientific occupations. A significantly higher percentage of SheaHomes owners than comparison owners have annual incomes that exceed $200,000.

Most of the buyers in the study came from San Diego, so they were already aware of the desirability of the Scripps Highlands location before the developments began. Majorities of the buyers became aware of the developments as they drove through the area. Word-of-mouth was the second most common source of information in learning about the new homes. There was so much interest that SheaHomes held a lottery to give potential buyers a place in line to select their lots and floor plans.

Environmentalism

Although environmentalism and early adopter characteristics are often associated with purchase of innovative "green" products, and high-performance homes could be seen as both innovative and protective of the environment, apparently these motivations do not distinguish the purchasers of high-performance homes from other new homebuyers. Indeed, support for environmental protection is so widespread in the population that we would be unlikely to discern differences among the categories of homebuyers at Scripps Highlands. The one difference found among the environmental variables is that SheaHomes purchasers significantly more frequently link household energy consumption with environmental problems than do comparison home purchasers. As noted, other home features are far more influential in home purchase decisions than are energy and environmental characteristics.

Surprisingly, respondents under 40 years of age exhibit lower support for the environment (and may even be characterized as anti-environmental in their attitudes), whereas those 40–49 years of age are more supportive toward the environment. Those 50+ in age are the most environmentally supportive. A significantly higher percentage of homeowners more than 40 years of age than of younger homeowners indicate they would take actions to preserve and improve the environment; the reason for this is not that older homeowners have higher incomes and could therefore be more financially able to purchase environmental products because statistical tests show that annual income does not vary by age category. So that is not the explanation. Instead, it could be that younger homebuyers are busier raising children and may expect sustainable attributes to be built into their homes

The Purchase Decision Process

Importance of Reasons for Purchase and Home Features in Purchase Decision

When considering 24 important reasons for purchase, responses are virtually identical between the SheaHomes and comparison homeowners. Only two reasons elicit a significantly different response. Comparison respondents rated the desirability of the area as more important to them, and SheaHomes buyers rated reputation of the builder as more important to them. Energy was not

a very important factor in the purchase decision for most of these new homebuyers. Concern for the electricity crisis in San Diego was also not an important factor.

When considering 15 home features, almost all were important to the purchase decision of the SheaHomes and comparison buyers. SheaHomes buyers assign higher importance ratings to quality of construction, availability of a three-car garage, and granite counter tops as standard than comparison buyers. Because SheaHomes prides itself on the quality of its homes' construction and positions its homes in the market based on quality, the company's marketing message about quality has apparently reached the home buying market.

From the study's qualitative data, we know that the aesthetics of solar features are not considered problematic by the SheaHomes buyers. However, those who might have been concerned about aesthetics probably would not have purchased the high-performance homes and their views would not be represented in this study.

Barriers to PV Purchase

If PV systems are offered optionally, the most important barriers to the purchase of optional PV systems are that potential buyers perceive the systems as too expensive and that payback would be too long. Main homebuyers who chose not to purchase homes with PV systems also indicate concerns about maintenance and system reliability.

Homebuyer Information Sources

The sales staff of both builder companies provided information on the homes, and the majority of buyers are satisfied with the job the sales staff did. The SheaHomes sales staff was the source of information on the energy features of high-performance homes, and SheaHomes buyers were, on the whole, satisfied with the job they did. The staff was also the single most important source of information on PV systems; 61% of PV owners relied on them for PV information. Other sources, used by far fewer PV homebuyers, include AstroPower, Inc., word-of-mouth, and SDG&E.

Satisfaction

Both categories of homeowners are quite satisfied with their new homes in general, as expected. A significantly higher percentage of SheaHomes owners than of owners of comparison homes (77% versus 67%) indicate they would buy the same house over again. Both categories of homeowners are satisfied with their homes' investment potential, location, size, and layout. A significantly higher percentage of SheaHomes owners than owners of comparison homes is satisfied with lot size, builder reputation, storage space, and quality of construction.

The evidence suggests that SheaHomes owners are more satisfied with their homes than the comparison owners are with theirs. Although this would not be the only factor affecting satisfaction, the comparison homeowners report significantly higher average monthly utility bills than do the SheaHomes owners. Whereas both categories of homeowners find their homes to be

comfortable, comparison buyers pay significantly higher utility costs to maintain their comfort levels than do SheaHomes buyers. The homeowners appear to perceive differences in their utility costs: SheaHomes buyers give their homes significantly higher ratings on energy efficiency (a mean score of 7.35 on a 10-point scale) than do comparison buyers (a mean score of 6.31).

After their experiences in living in their new homes, SheaHomes owners, and especially PV owners, indicate they are significantly more knowledgeable about savings on utility bills, tax credits, rebates, interconnectivity issues, and system performance than they were before they moved in.

We believe the findings from the utility analysis (discussed in this conclusions chapter) are directly related to homeowner satisfaction. In response to the homeowner questionnaires, 52% of respondents from SheaHomes with PV systems agree or strongly agree that they are satisfied with the savings on their utility bills, whereas 16% disagree or strongly disagree and 32% are unsure. Of the SheaHomes respondents without PV systems, only 28% agree or strongly agree that they are satisfied, while 25% disagree or strongly disagree and 47% are unsure. Clearly, a higher percentage of PV homeowners are satisfied with the savings on their utility bills than non-PV homeowners, but among both groups, the percentage who are unsure is also quite high. Further, 49% of respondents from SheaHomes with PV systems agree or strongly agree that their gas bills are lower than they would have been without their solar preheating water system, whereas 21% disagree or strongly disagree and 30% are unsure. Fifty-one percent of non-PV SheaHomes owners agree or strongly agree that their utility bills are lower than they would have been without solar preheating water systems, while 17% disagree or strongly disagree and 32% are unsure.

PV Ownership

By and large, those who knowingly selected homes with solar PV systems are very much like all other homebuyers in the SheaHomes and comparison communities. The few differences in the survey responses detected through detailed data analysis apply mostly to the PV owners. The findings suggest that those consciously opting for homes with PV systems tend to be male heads-of-household in their 40s with training as scientists and engineers.

Characteristics of PV Homebuyers

The PV homebuyers are not early adopters of an innovation: they do not have higher education, occupation, or income levels than other homebuyers; they do not display more early-adopter characteristics, such as opinion leadership, than others; and they are not more environmentally oriented than others. These are regular homebuyers buying new upscale homes.

We proposed a new category of high-performance homebuyers that we term the *unwitting adopter*. Although they bought homes with PV systems, these homebuyers were unaware of the fact until after they had been living in their new homes. The existence of unwitting adopters has important implications because it suggests that ordinary homebuyers can and do purchase high-

performance homes on the basis of non-energy criteria, which in turn suggests that high-performance homes with PV systems can be sold to ordinary homebuyers without offering PV systems as special options.

The PV Purchase Decision Process

Patterns of response on the importance of reasons for purchase differ by PV ownership. On average, PV owners rate all reasons included in the study as *less* important than do owners of PV-eligible homes who chose not to purchase PV systems, *except* the "Availability of a PV system" and "The package of energy features." These are rated significantly higher by PV owners than by the buyers of PV-eligible homes who chose not to purchase PV systems. These findings lead us to conclude that those who purchased PV homes brought a greater concern about energy to the home purchase decision than did main buyers who chose not to purchase PV homes or comparison buyers. Most homebuyers may not have been very knowledgeable about the energy features when they purchased their homes, but more than three-quarters of the PV owners (77%) feel knowledgeable *after* living in their homes—a significantly higher percentage than non-PV owners (64%).

Homeowner Satisfaction with the Home by PV Ownership

Non-PV owners, on average, assign significantly higher mean satisfaction ratings than PV owners to the location, home size, lot size, layout, and storage space of their homes. PV owners assign higher mean satisfaction ratings to energy features than do non-PV owners, and 77% of them rate themselves satisfied or very satisfied with the package of energy features, compared with 67% of non-PV SheaHomes owners. However, these differences are not statistically significant.

Information Levels of PV Homebuyers

Most of the PV buyers (57%) feel they were not very well informed when they made their decision about PV ownership. Although some information on PV systems was available through a fact sheet, an operating manual on PV systems, web sites, and a video on operations and maintenance, it has not been easy for PV owners to locate and obtain information on their PV systems. Based on our field work, once homes were sold, SheaHomes university did not routinely include energy efficiency, solar water heating, and PV systems in its training curriculum for new homebuyers. Because approximately 10 PV respondents contacted researchers with questions about their systems and how to get information about them, NREL prepared and mailed a letter to SheaHomes PV owners providing information on points of contact for them to pursue, including SheaHomes customer service and AstroPower, Inc.

PV owners seem to have a continued need for technical assistance that could be filled by PV brokers working with new homebuilders. This finding is important because misperceptions about

PV systems could be corrected,[1] levels of satisfaction could be increased, and the beneficial interactive effects between the PV owners and their systems relative to energy efficiency of the home could be reinforced.

Perceived Benefits of PV Ownership

PV owners were presented with 15 statements on potential benefits from owning PV systems; when factor analyzed, these responses result in three factors. The first factor reflects responses for "altruistic" benefits of PV ownership, such as helping to reduce global warming, helping the local economy, benefitting future generations, and helping to improve air quality in the area. This factor closely resembles the first factor of perceived benefits of retrofit grid-tied PV ownership in the study of Colorado homeowners (Farhar and Coburn 2000).

The second factor reflects responses on the financial advantages of PV ownership, such as reduced electricity bills, free electricity once the system is paid for, selling electricity back to the utility company, and increasing the home's resale value. This factor is quite similar to the second factor of perceived benefits of PV ownership termed "financial advantages" in the Colorado study.

The third dimension reflects responses that appear to focus on the personal satisfaction that can be derived from owning and living with a PV system, such as increased self-sufficiency, being technologically innovative, and feeling good about owning it. Although not identical to the third factor in the Colorado study, this dimension is similar in that the items defining it pertain to personal satisfaction provided by being first on the block with a new PV system and enjoying a new technology.

The fact that these factors emerge from both analyses of two different sets of respondents —owners of new grid-tied PV homes in San Diego and owners of existing homes in Colorado responding to the *idea* of grid-tied PV retrofits—suggests that these perceptions of benefits apply to both new and retrofit markets for PV systems. In the San Diego case, homeowners were responding after experiencing PV systems. In the Colorado case, homeowners were responding only to the *idea* of owning them.

We believe that the energy features, and in particular the PV systems, were icing on the cake for the SheaHomes buyers. These factors seem to describe the flavors of that icing—the aspects that various PV owners appreciate the most: altruistic benefits, financial advantages, and personal satisfaction.

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[1]One such misperception is that if a PV system is sized at 2.4 kW, it should produce 2.4 kW of electricity. Not so, according to AstroPower, Inc.; technically, the system produces less. Presenting the technical details about why this is so is beyond the scope of this report. But it is an important point bearing on the perception of PV systems by owners who are carefully monitoring what is going on with their systems and homes. It should not be ignored.

Satisfaction with Utility Bills

A significantly higher percentage of PV owners than non-PV SheaHomes owners (not comparison owners) are pleased with utility billing processes and believe that electricity rates have come down. Most of them have bragged to others about their utility bills (67% compared with 26% of non-PV owners bragging about theirs). PV owners, in particular (52%), indicate that their expectations for utility bills have been met, compared with 28% of non-PV owners. Living in PV homes has resulted in significantly lower utility bills, by owners' estimates,[2] than those reported by the rest of the homebuyers. The PV experience has also apparently resulted in an even more positive attitude toward the desirability of energy efficiency and solar features in new housing, and an intention to buy such housing in the future should the PV homeowners move.

Although the analysis suggests that PV owners are somewhat less satisfied than other buyers with the investment potential of their homes, objective analysis of home resale values shows that PV homes more than hold their own in the resale market. The PV owners will very likely become aware of this advantage over time, if they have not already.

The ZEH Experience

The findings reasonably support a conclusion that, once homebuyers experience living in highly energy-efficient homes with solar water heating and PV systems, they become more favorable toward their homes. As noted, buyers of high-performance homes with PV systems are, by and large, like the buyers of other nearby homes of similar qualities and in a similar price range. It is not qualities they brought to the home purchase decision, but rather the *experience of PV ownership* that changes their attitudes and perceptions.

Surprisingly, despite experiencing some difficulties with interconnectivity agreements, PV owners have more positive attitudes toward SDG&E than do SheaHomes non-PV owners. PV owners are significantly more pleased with utility billing processes than are non-PV owners, and they are significantly more likely to believe that electricity rates have come down than are non-PV owners. This appears to be another sound reason for utility companies to actively support net metering for new and retrofit housing.

Conclusions from the Utility Analysis

One of the most unusual and significant aspects of this study is that actual utility data were available for analysis rather than estimates or homeowner perceptions. This information, which consists of records of gas and electricity cost and consumption obtained directly from SDG&E, represents "real world" measurements recorded for homes that encompass a wide range of household types, homeowner lifestyles, and equipment and amenity configurations.

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[2]As well as by our analysis of utility bills.

Utility consumption and cost were found to be highly variable quantities for all the homes included in the study. Some of this variation is attributable to normal seasonal cycles, but occupant behavior also plays a role, as do homeowner decisions to improve their homes with energy-intensive equipment and amenities such as pools, hot tubs, and multiple refrigerators. An interesting finding relative to variability comes from visual inspection of the line graphs of electricity and gas consumption of the individual homes in the study. The line graphs on energy consumption of the individual SheaHomes show that the houses built earlier in the project exhibit greater variability in electricity and gas consumption than do the houses built later in the project. This decrease in variability over time suggests that SheaHomes became more effective in implementing the high-performance home designs with more practice. In other words, the builder got better at building the high-performance homes, and this improvement is reflected in the energy consumption data for individual homes.

In addition, it became clear over time that certain PV systems were down for maintenance at various times during the study period. Although we have no data on the exact dates of downtimes, we infer that at least some of the higher months in the electricity consumption of solar PV homes coincide with periods of maintenance.

The Delivery of High-Performance Homes on the Promise of Saving Energy Costs

The original SheaHomes concept has been borne out by the utility analysis. The homes were originally advertised as providing homebuyers with the potential to reduce their utility bills from 30% to 50% over conventionally built homes. At the time San Angelo and Tiempo were planned, ConSol, Inc., estimated that the homes would save 38% of heating, cooling, and water-heating energy beyond the California Title 24 guidelines in effect at that time (Hammon 2004).[3] The 38% energy savings was estimated to convert to 14% of actual cost savings over standard Title 24 houses without solar electric systems. Electricity cost savings attributable to the solar electric system would be in addition to the 14% savings.

Recall that all SheaHomes were more energy efficient than were ENERGY STAR homes, that 296 of them had solar water heating standard, and that 120 of them had PV systems. Among the homes studied, SheaHomes were found to consume less electricity and gas, on average, than comparison homes. Similarly, SheaHomes incur lower utility costs (electricity, gas, and combined utility bill), on average, than comparison households. This finding, in and of itself, essentially validates the SheaHomes construction concept.

Results from comparisons of average monthly combined utility bills (including taxes and miscellaneous charges) among various categories of homes are itemized below:

- When we examine the data for SEE homes (that is, SheaHomes that are highly efficient with solar water preheating systems but without solar PV systems) versus comparison homes, we

[3]These were the older Title 24 guidelines in effect prior to 2005.

find 14% actual average monthly cost savings (including taxes and miscellaneous charges), as had been predicted.

- When we examine the data for SheaHomes versus comparison homes, we find 23% lower combined average monthly utility bills (including taxes and miscellaneous charges) for SheaHomes than for comparison homes.

- When we compare all PV homes (both 1.2-kW and 2.4-kW) to comparison homes, we find a 36% saving in average monthly electricity costs and a 27% saving in average monthly gas cost, and a combined average monthly utility cost saving (including taxes and miscellaneous charges) of 33%.

- The combined average monthly utility bill for homes with 1.2-kW systems is 35% lower than for the comparison homes.

- The combined average monthly electricity cost for homes with 2.4-kW systems is 63% lower than for the comparison homes.

- The combined average monthly total utility bill for homes with 2.4-kW systems is 54% lower than for the comparison homes.

These findings are all statistically significant at p=.05, except for the difference in average monthly combined utility cost between the SEE and comparison homes (p=.122). Thus, the story on energy and cost savings is more complex than was understood when San Angelo and Tiempo were designed and built.

The utility consumption and cost advantages realized in SheaHomes are even more remarkable because SheaHomes (for which actual utility data are available) are larger than comparison homes, and there are no statistically significant differences between the two with regard to household makeup or number of occupants. On the other hand, a significantly higher percentage of the comparison homes include pools and hot tubs.[4] This finding suggests that, as anticipated, homeowner choices about energy-intensive equipment and amenities have an important bearing on actual utility consumption and cost, and that the presence of such features is critical to interpretation of the data.

Energy efficiency and solar features help energy costs in another way. SDG&E calculates energy charges using a daily baseline allowance that varies by climate zone and seasonal time of the year, among other variables. Between May and October 31, the daily baseline allowance for electricity is 11.8 kWh and between November 1 and April 30, it is 11.5 kWh. Similarly, the summer daily baseline allowance for natural gas is 493 therms, and for winter it is 1.546 therms.

[4]Fifty-eight percent of comparison homes and 26% of SheaHomes for which there are utility data had pools and/or hot tubs. The comparison homes did not come with pools or hot tubs standard. Of the 44 SEE homes, only 10 (23%) have pools and/or hot tubs, whereas of the 26 comparison homes, 15 (59%) have pools and/or hot tubs.

Electricity costs rise based on the amount of electricity used above the baseline allowance. "The cost per-unit increases as energy use increases."[5]

A closer investigation of the SheaHomes data suggests that most of the utility consumption and cost advantages realized among that group of homes is found in those with PV systems. In particular, SheaHomes with PV systems have significantly lower average monthly electricity consumption and cost than SEE homes,[6] but average monthly gas consumption and cost for the two groups, although 17% lower for PV homes, are statistically equivalent at p=.05. Both categories of SheaHomes (those with PV systems and SEE homes) are highly efficient homes with solar water preheating systems.

Further, the most significant savings among SheaHomes relative to comparison homes are realized in those equipped with the larger, 2.4-kW systems. In fact, although the number of PV homes in the study with 2.4-kW systems is small, the mean savings in average monthly electricity cost is approximately 63% relative to comparison homes, an amount that is consistent with the reductions reported in other studies, and about 57% relative to the high-performance SEE homes. If only the PV homes with 1.2-kW systems are considered, the mean savings in average monthly electricity cost is about 30% relative to comparison homes and about 19% relative to the SEE homes. Because of the rigorous nature of our investigation, we believe our results validate and strengthen our claim that 2.4-kW or larger systems on top of high energy efficiency levels and solar water heating are needed to effect the most significant cost savings.

Additionally we found that average monthly electricity consumption and cost were not significantly different for comparison homes and SEE homes, except when computed on a square-footage basis. On the other hand, we found that the mean differences in average monthly gas consumption and cost for these two groups of homes, though not large, were significant, with the mean amounts for the SEE homes being lower (in the 17%-18% range for both consumption and cost). While the SheaHomes in this particular comparison are not equipped with PV systems that can lower electricity consumption, they do have solar water heating systems that help reduce gas consumption.

Taken together, the results reported in the section on satisfaction discussed earlier in this chapter suggest that most homeowners believe their solar preheating water systems are helpful, but that adding solar preheating water systems alone to highly efficient homes is not enough to effect a level of savings of monthly utility cost that is obvious to them. On the other hand, the effect on cost of the energy package together is much more readily apparent to homeowners because of the savings realized especially on electricity consumption.

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[5]www.sdge.com/customer/baseline.shtml (accessed 7/18/06).

[6]SheaHomes without PV systems, excluding early homes (which had no solar water preheating systems) and outliers from the analysis.

At the time solar features were added at San Angelo and Tiempo, the houses were evaluated for suitability for PV. An effort was made to install solar water heating and PV systems on the side and rear roof exposures. An examination of the site maps suggests that the houses with PV systems standard may have had more optimal orientation for solar water heating systems. This is because if the house had a PV system it probably had a south-facing solar water heating system. The percentage difference in monthly gas cost between base-case PV homes and base-case comparison homes is 50% (with the PV home costs lower) almost double the 27% difference when all PV and comparison homes are compared.

Although the results reported above reflect real-world conditions in homes representing a broad spectrum of features, the presence of energy-intensive equipment and amenities confounds the interpretation of the data, as suggested above. Hence, we believe it is necessary to consider additional comparisons of utility consumption and cost in homes that do not include any of these features. Such homes, which are here referred to as base-case homes, would be purchased in their "raw" or "natural" state before any additional equipment or features are installed. Among these homes, we found base-case SheaHomes with energy efficiency, solar water heating, and PV systems had significantly lower average utility bills than either the base-case comparison homes or the base-case SEE homes with energy efficiency and solar water heating. The mean difference in average monthly electricity cost between base-case PV homes and base-case comparison homes is approximately 42%, and for average monthly gas cost it is about 47%. The mean difference in average monthly electricity cost between base-case PV and SEE homes is approximately 47%, and for average monthly gas cost it is about 34%. Although the numbers of homes involved in these comparisons are relatively small, the findings are especially significant because they fundamentally validate the overall benefits of PV added to high-performance homes with solar water heating for the residential market in terms of savings in both electricity and gas costs.

On the other hand, we find the mean difference in average monthly electricity cost is not statistically significant at $p = .05$ for base-case comparison homes and base-case SEE homes, nor is the mean difference in average monthly gas cost. In fact, average monthly electricity cost is slightly higher (about 9%) for the base-case SEE homes than for the base-case comparison homes, whereas average monthly gas cost is about 20% lower for base-case SEE homes with solar water heating than for base-case comparison homes. Again, the number of homes involved is small, but the results are somewhat surprising; perhaps part of the reason for this finding is that the comparison homes were built to the Title 24 building code in effect in 2001. We conclude that buyers of basic high-performance homes (such as the SEE homes) may not experience much difference in their average monthly electricity cost relative to buyers of Title 24 comparison homes, but that they may experience somewhat lower average monthly gas cost. However, in terms of average monthly combined utility bill, base-case SEE homes are not significantly different from base-case comparison homes, indicating the apparent reduction in average monthly gas cost (presumably the result, in part, of the presence of solar water heating systems) is not enough to offset higher average monthly electricity cost in the SEE homes.

Feedback and the Interactive Effect between Technology and Behavior

Considering all these findings and conclusions together, it appears that, relative to more conventional comparison homes, true savings in utility consumption and cost can only consistently be obtained when energy-producing technology (such as PV systems) is in place on top of energy efficiency and water heating technologies. Interestingly, other findings from this study suggest that PV ownership tends to foster increased interest in, and enthusiasm about, the technology, which may translate into energy-saving behaviors. In fact, the presence of a physical feedback device (the digital display) in the PV homes is closely linked to satisfaction with these systems and to an expression of pro-solar-energy beliefs and behaviors. When PV systems are producing more electricity than is being consumed, the electric meter runs backwards, which provides additional feedback and satisfaction to PV owners.

Additional analysis suggests that living with the systems, whether or not there is specific intent to acquire them from the outset, promotes increased familiarity with, and interest in, those systems that ultimately leads to heightened awareness of energy consumption and conservation and changes in energy consumption behaviors. Hence, we conclude that, although the presence of the PV systems is very important, the behavioral interaction of the consumer with the technology based on the digital display—and to some extent the electric meter—provides feedback that produces the most pronounced effect on homeowners. The fact that the base-case SEE owners do not have feedback devices and that their energy consumption and costs, though lower, are not on average, significantly lower at p=.05 than comparison homeowners adds further evidence to the significance of feedback in optimizing energy and cost savings.

Perceived versus Actual Utility Bills

Homeowner estimates of their monthly utility bills are notoriously inaccurate. The study provided a rare opportunity to compare the amounts of monthly utility bills that homeowners estimated they were paying with the amounts they were actually paying, at least for those homeowners who released their utility bills. Because homeowners tend to think about what their utility bills are running per month, this analysis used monthly averages of the total utility costs since the homeowners moved in. We found that SheaHomes respondents report significantly lower average monthly utility bills ($143.08) than do comparison respondents ($184.55), and that their estimates are less variable than those of comparison respondents.

When we compare perceived to actual mean monthly utility bills (limiting the analysis to those whose utility data we have and using weighted means), SheaHomes respondents estimate average monthly utility bills of $165.44, but their actual average monthly bills are significantly lower at $139.11 (p=.000). Similarly, comparison respondents report average monthly utility bills of $210.01, but their actual average monthly bills are significantly lower at $164.03 (p=.008).

Clearly, PV owners report significantly lower average monthly utility bills ($116.44) than do SheaHomes non-PV owners ($159.73) (p=.003). When we compare perceived to actual utility bills (limiting the analysis to those whose utility data we have and using weighted means), PV

owners estimate average monthly utility bills of $118.55, but their actual mean monthly utility bills are significantly lower at $105.54 (p=.029). Owners of SheaHomes non-PV homes estimate their mean monthly utility bills at $194.73, but their actual mean monthly utility bills are significantly lower at $160.08 (p=.000).

We conclude that all homeowners tend to overestimate their average monthly utility bills to an extent that is statistically significant. Ownership of homes with PV systems is associated with a more accurate perception of utility costs than other SheaHomes and comparison homeowners have. Comparison homeowners have the highest overestimates of their average monthly utility bills.

Conclusions from the Modeling Work

The primary objective of our modeling exercise was to develop straightforward and logical equations with which to forecast or predict utility consumption and cost in new construction. Such forecasts or predictions would be extremely beneficial to homebuilders as they plan and market new homes and developments, as well as to consumers who are contemplating the purchase of a new home. The ultimate goal of this work would be to provide a straightforward and reliable way to calculate utility consumption and cost under a variety of home/household configurations and lifestyles.

We demonstrate that, at least in the case of PV and comparison homes, utility consumption and cost can be reliably modeled by an equation containing a relatively small number of variables (on the order of three to six). However, even though most of these variables involve the presence of tangible equipment or amenities, some relate to occupant behaviors, attitudes, or perceptions that may be more difficult to pin down. On the whole, the best models of utility consumption and cost that can be constructed involve the interaction or interface of homeowners with various equipment and amenities, and we conclude that consideration of both kinds of variables is necessary to optimally model the utility response in homes.

The utility response in SEE homes is much more difficult to model. These homes/homeowners appear to be a unique category with utility response patterns that are more closely tied to occupant behaviors, attitudes, and perceptions than to the presence of specific energy-intensive equipment and amenities. Such variables are certainly more intangible and are likely interrelated in ways that are not completely known. Both situations can counteract and even defy the development of mathematical equations that reliably explain and predict utility consumption and cost.

The Business Aspects of High-Performance Homes

The builder's experience and perception of the project were documented through in-depth interviews with the executives and staff, as well as review of the SheaHomes contractor reports and media coverage, and through public records. SheaHomes, in completing its San Angelo and Tiempo developments, accomplished a complex technical and institutional achievement. Besides

selling all 306 homes in 31 months, the builder also sold almost half of them with solar PV systems. SheaHomes sold three times as many homes as the comparison builder in the same length of time. In this section, we discuss conclusions about the competitiveness of high-performance homes, the business experience of SheaHomes in offering high-performance homes, the role of the builder staff, the uptake of PV systems, the optimal development of high-performance homes, and the resale value of high-performance homes.

Are High-Performance Homes Competitive on the Market?

The study's findings do not support a widely held belief that new high-performance homes are more expensive than conventional homes on the market. The mean price per square foot of the high-performance homes in this study was significantly lower than the mean price per square foot of the comparison homes, which came with no extra amenities standard.

Benefits and Costs to the Builder

SheaHomes enjoyed economic advantages for building high-performance homes. The company received a 50% subsidy on the cost of the PV systems from the CEC—the first time a residential builder in California had received the subsidy from the state. The company also received a $750 rebate from SDG&E for the installation of solar water preheating systems at each home and enjoyed a 15% tax credit for energy-efficient housing that was more than 15% more efficient than Title 24 housing (the standard in effect in 2001).

SheaHomes also enjoyed several other benefits from completing its Scripps Highlands project, including (1) partnerships with organizations interested in solar energy and energy efficiency, (2) extensive media coverage of its innovative developments, (3) enhanced reputation by becoming an innovator with high-performance home technology, and (4) greater exposure to the home buying market. Other benefits may have also accrued to the company through the contacts the company forged in its work with DOE, NREL, the State of California, and with San Diego city government. These benefits, with time, could translate into economic advantages.

SheaHomes management said that the San Angelo and Tiempo homes sold out a year faster than expected, and attributed the accelerated sales pace to the desirable location. This is interesting because the comparison development had model homes for potential buyers to visit, whereas many of the earlier SheaHomes buyers, when they bought their homes, could see only the undeveloped land, pictures of elevations, and drawings of floor plans. SheaHomes did not build its model homes until late in the sales process. This made the sales process between SheaHomes and comparison homes an uneven playing field in favor of the comparison homes; therefore, it seems remarkable that the two developments sold out in the same length of time. This suggests that, all other things being equal, the high-performance homes would sell more quickly than conventional homes (despite the management view in July 2003).

SheaHomes management also told us that the company did not lose money on the energy efficiency and solar energy attributes of the high-performance homes, but they seemed to indicate that the homes were not that profitable, either. The company did not share proprietary

information with the researchers on its expected or actual profits from the San Angelo and Tiempo developments.

SheaHomes staff indicated, however, that they hoped that the City of San Diego would view the Scripps Highlands communities favorably. The company planned to work with the City on a project to provide affordable housing with high-performance features in the San Diego area. This became the Bella Rosa affordable housing development.

The Scripps Highlands experience was something of a double-edged sword for SheaHomes. Several of the benefits also involved costs. These included costs of (1) building high-performance homes, despite rebates; (2) climbing the learning curve, including new language and acronyms; (3) selling and scheduling installation of optional solar PV systems; (4) obtaining the rebates for the PV systems; (5) dealing with interconnectivity issues; (6) dealing with tax implications for customers; and (7) educating visitors and new homebuyers about the homes' innovative energy features. In addition, SheaHomes was concerned about whether high-performance homes could be sold at prices that were competitive with conventional new home prices in the area.

SheaHomes managers also pointed out that they took some informal complaining and grumbling from members of the San Diego homebuilders association for building the Scripps Highlands project. To speculate on this phenomenon, in building San Angelo and Tiempo, SheaHomes took a highly innovative step. It is the normal social process in any social group to sanction members who are perceived as deviating from group norms (in either positive or negative directions). This dynamic is similar to the sanctions that hourly-paid factory workers impose on a "rate-buster."[7] It must be acknowledged that innovative builders stand out from the builder community within which they are embedded, and they could face informal sanctions from other builders. This phenomenon should be offset with higher financial incentives for ZEH builders.

What Was the Uptake of Optional Solar PV?

Ryan Green and the company were interested in knowing what the uptake of homes with PV systems would be. Of the total 306 homes, only 260 were PV-eligible. Of these 260 homes, 120, or 46%, were actually sold with some sort of PV system. Of these 120, 96 were sold with 1.2 PV systems standard. The remainder of the homebuyers chose to purchase either 1.2 PV systems or 2.4 PV systems optionally. In addition, eight of the 96 buyers that purchased homes with PV systems standard chose to upgrade their 1.2 PV systems to 2.4 PV systems. Hence, a total of 32 homebuyers made an optional PV purchase. These 32 home represent 27% of all the homes sold with PV systems or 12% of all PV-eligible homes.

Clearly, homes with PV systems standard can be sold, since not one of these homes remain unsold today. However, the findings presented above paint a picture of only limited market interest in solar PV systems offered as optional features. This picture influenced SheaHomes

[7]A "rate-buster" is a worker who works much harder and produces much more than the group norm.

management when it made its decision to discontinue building high-performance homes in other projects it was planning (see Chapters 2 and 4).

Our research suggests several reasons why homebuyers may be reluctant to consider an optional purchase of a PV system. However, we believe the seemingly lackluster sales of optional systems was due more to ineffective marketing than lack of homebuyer interest. In the course of our research, we discovered that only 44% of buyers of PV eligible homes remembered being offered an optional system. Thus, 56% of buyers of PV-eligible homes at Scripps Highlands were apparently not offered such systems. When we examine the data with this knowledge in hand, we observe that, of those who remember being offered optional PV systems, 46% actually purchased them. Extrapolating to all the PV-eligible homes at Scripps Highlands, we estimate that 44% would have purchased the systems had they been offered. Obviously, this is a much higher percentage than the 12% figure reported above. So the market interest in optional PV systems appears to have been much higher than these figures would indicate. They suggest that, had buyers been aware of solar PV options, another 40 to 50 homebuyers at San Angelo and Tiempo would have purchased 1.2-kW systems or would have upgraded to 2.4-kW systems.

The Roles of the SheaHomes Sales and Options Staffs

The question might be asked why 56% of the buyers of PV-eligible homes were not offered the option. Although the lead sales agent was enthusiastic about solar PV, in the end the sales staff were more concerned about finalizing home sales, for which they were rewarded with commissions, and they were less focused on sales of PV systems that were considered "extracurricular" and might complicate the deals. Sales people learned that homebuyers in general are not likely to be well informed about solar PV systems (although a few were sophisticated about energy features), and that educating them would take a fair amount of time. Also, the sales staff was the major source of information for homebuyers, and they, themselves, were not fully informed about the utility cost savings that could be expected from the homes and the PV systems. This is not to fault the sales staff, who are quite effective at what they do, and who are much appreciated by the homebuyers. More needs to be known about the energy and cost savings of high-performance homes and ZEHs, and the sales staff were probably as informed as they could be at the time the Scripps Highlands project was going on.

We also learned through qualitative work that the individuals whose job it was to offer optional features to the buyers were apparently uninformed about the PV systems (including their placement on the roofs and other aspects). Undoubtedly, this prevented some systems from being sold or upgraded because buyers could not get answers to their questions rapidly, and they had hundreds of other decisions to make at the time.

Management Decisions

To continue our discussion, then, upper management at SheaHomes-San Diego realized that only a small percentage of PV-eligible homes were selling with optional PV systems. On the other hand, they were undoubtedly unaware that the majority of the buyers of PV-eligible homes had not been offered the PV option. Thus, SheaHomes management may have decided to discontinue

its pursuit of high-performance homes in its upcoming developments based on inaccurate or incomplete information.

Based on this analysis, we conclude that inadequate information on the part of the builder can lead to premature withdrawal from the market. In addition, when the innovation champion (in this case, Ryan Green) leaves the company, such projects will likely flounder. For high-performance homes projects to succeed, their champions must be heirarchically located at or near the top of the company, have the support of the top management team, and provide follow-through to the end of, and possibly even beyond completion of, the projects.

SheaHomes is an industry leader in offering quality upscale energy-efficient solar homes. The company was a participating builder in the Ladera Ranch project. Its reputation still remains, even though SheaHomes is not pursuing ZEH concepts in any of its current developments in the San Diego area. If another San Diego large-production builder aggressively pursues the development of PV homes and establishes a reputation, SheaHomes could eventually lose this specific market advantage that it enjoyed because of Scripps Highlands. However, SheaHomes has kept the door open to future use of ZEHs, although management said the company wants to better understand costs, benefits, and market response before committing to another project.

Optimal Development of High-Performance Homes by Large-Production Builders

From this experience we learned that offering energy efficiency and solar features standard does not interfere with homes sales; in fact, it may have accelerated home sales. We learned that this is *not* a "niche market," as is commonly believed. However, because PV technology is complex, unfamiliar, and costly, buyers have difficulty making decisions about whether to purchase it. When PV systems are offered optionally, customers weigh them against aesthetic features of their homes, such as granite counter tops. Yet PV systems are part of a home's basic equipment and structure, so to many customers the decision felt like comparing apples and oranges.

Also, offering optional PV systems seems to be burdensome for large-production builders because the transaction costs of scheduling system installation are higher than if the installations were routine for each house, and sales staff have to sell the solar PV systems in addition to the home itself. These considerations lead us to believe that PV systems should be offered standard. Including PV in the price of the home streamlines PV purchases, and PV homebuyers will experience lower utility (especially electricity) bills than they would have otherwise. The home price does not necessarily increase noticeably where subsidies are in effect.

Therefore, from a business perspective, future new home developments should feature highly energy-efficient new homes with solar water preheating and tankless water heating, and PV systems standard. PV service providers, broker companies, or installers trained to provide turnkey packages rather than builders, should handle the technical details of PV installation. These include ordering or bulk purchasing the PV systems, providing qualified installers, post-installation inspection, dealing with interconnectivity for net metering, dealing with rebates and tax credits, and handling any callbacks related to PV systems.

In addition, larger PV systems are needed (at least 2.4-kW and preferably larger yet) so that homeowners can clearly perceive the effects of the PV systems on their utility bills. The PV owner perceptions were discussed in an earlier section of this chapter.

The heating and air-conditioning systems in these homes should be highly energy efficient. Dual-zone heating and air-conditioning systems should be provided standard for two-story homes. The new home package would ideally include ENERGY STAR appliances. If appliances are not included, homebuyers should be encouraged to select energy-efficient appliances, for which their utility company could provide rebates.[8] Highly efficient homes with solar water heating and PV systems standard will be more profitable for builders and sales staff, more beneficial for utility load profiles, and more cost-effective for homebuyers.[9]

The Increase in Property Values of High-Performance Homes over Time

High-performance homes not only hold but increase their value at a faster rate than do conventional homes. Both SheaHomes and comparison homes increased markedly in value at resale. Five percent of SheaHomes had been held an average 22.5 months and 13% of comparison homes 28.1 months before resale at some 42 months after the developments were begun in the spring of 2001. Owners of SheaHomes realized a higher percentage of financial gain when compared to the nearby comparison homes, despite the similarities between the two groups of homes in location, original sales price, and square footage. Resale prices for 29 homes analyzed (the first 29 homes sold in the area[10]) show that the increase in value for SheaHomes averaged 55.4% and 44.7% for the comparison homes. The mean gain in sales price for SheaHomes was $306,509 over original price. The most expensive home sold for $1.1 million. The mean gain in sales price for the comparison homes was $264,562 over the original price. The most expensive comparison home sold for $995,000. Comparison homes also apparently turn over sooner than do SheaHomes—that is, two and one-half times the number of comparison homes than of SheaHomes were sold in the 42 months—which could be related to their owners' somewhat lower levels of satisfaction. Although we do not have data in this study on all of the variables that could affect resale value, it seems reasonable to partially attribute the difference to the energy features of the SheaHomes.

Answers to the Advisory Group's Questions

As mentioned in Chapter 2 (Guiding Ideas), the study's advisory group recommended that the research address a specific set of questions. Briefly, the answers to these questions are presented here.

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[8]Federal tax credits are currently provided tax credits for energy efficiency features, including windows and water heaters.

[9]The caveat that this is not an economic analysis must be repeated here. This refers to a utility bill savings effect that is large enough to get the notice of homeowners, but is not a reference to results of a cost-benefit analysis.

[10]By 2/7/05.

1. *How much did buyers know about the energy features of the homes? How well do the consumers understand them? What messages are the sales staff communicating about the energy features?*

   The buyers were relatively uninformed about the energy features of the homes before they bought them. SheaHomes respondents rate themselves with a mean score of 5.73 on a scale of 1 to 10, and comparison respondents rate themselves at 4.81, on average. Indeed, a handful of buyers actually bought homes with PV systems and did not know it! SheaHomes buyers are, in general, satisfied with the information received from sales staff on energy features, giving average ratings around 7 on a 1 to 10 scale.

2. *What is the role of the home builder "image" and reputation in the sales of the ZEHs?*

   The reputation of the builder was significantly more important in the home purchase decision to SheaHomes than to comparison homebuyers. Its average importance rating was 3.96 on a 1 to 5 scale among SheaHomes purchasers and 3.57 among comparison buyers, a difference that is statistically significant at p=.05.

3. *Do ZEHs have more market value than conventional homes and resale homes? Did energy features bring out people who were originally shopping for resale homes as well as new homes?*

   The SheaHomes at Scripps Highlands originally sold for somewhat less than the comparison homes. The mean price of the SheaHomes was $556,344; the mean price of the comparison homes was $598,028. The most expensive home at SheaHomes sold for $701,184, and the most expensive comparison home sold for $711,887.

   However, the situation is reversed at resale. SheaHomes experienced a mean dollar gain of 55.4% for a mean length of 22.5 months of ownership. Comparison homes experienced a mean dollar gain of 44.7% for a mean length of 28.1 months of ownership. The mean resale prices of the SheaHomes and comparison homes were nearly identical; for SheaHomes the mean resale price was $862,853 and for comparison homes it was $862,590. The most expensive resale home at SheaHomes sold for $1.1 million by February 2005. The most expensive resale comparison home sold for $995,900 by that date. The mean dollar gain per month owned was $14,492 for SheaHomes and $9,301 for comparison homes.
   More than double the percentage of comparison homes than SheaHomes were resold in the first 42 months of ownership. Comparison owners are, on average, less satisfied than are the owners of SheaHomes. Seventy-seven percent of SheaHomes owners say they would be willing to purchase their same homes all over again, compared with 67% of comparison owners; 5% of SheaHomes owners would be unwilling to do so, whereas 15% of comparison owners would be unwilling to purchase their same homes over again.

   Based on the survey data, the energy features did not result in visits by more buyers who were looking at both new and resale homes. In fact, 72% of comparison buyers indicate they

visited resale housing, whereas 57% of SheaHomes buyers visited resale housing, a difference that is statistically significant ($\chi 2=3.835$; $p=.05$). The lost lookers study (Collins 2003) suggested that visitors were not necessarily drawn by energy features, and in fact some were *unaware*, even after their visit to Scripps Highlands, that SheaHomes offered special energy features in their homes.

4. *What is the additional value to the customer of these systems? What price could be added to the price of a ZEH over a conventional home?*

It is, of course, interesting that the high-performance homes sold for *less* than the comparison homes. The data on willingness-to-pay, collected from non-PV and comparison owners (that is, buyers who did not purchase PV homes), suggest a cut-off point of approximately $5,000 for a system that would save 60% to 70% of electricity costs. However, this level of savings would require a larger PV system. SheaHomes buyers who upgraded their PV systems from 1.2-kW to 2.4-kW paid an additional $4,000; those who purchased optional 1.2-kW systems paid $6,000 (later raised to $7,000); those who purchased optional 2.4-kW systems paid $10,000 (later raised to $11,000). Reasons for not purchasing a PV system tend to center around the expense. Subsidies and amortization would be required to permit installation of the larger 2.4-kW to 3-kW systems that would be needed to reduce electricity costs by 60% to 70%.

5. *To what extent are energy performance features important in drawing people to look at the homes? To buy the homes?*

The energy features—and the media attention they generated—drew significant numbers of people to the SheaHomes Sales Center, but many of these people were not buyers. They were interested in solar energy and how it worked, but they were not actively looking. In fact, some mentioned they were thinking of building their own homes and wanted more information.

The data from the buyers showed that energy features are far less important in the purchase decision than issues like location, the safety and security of the area, and the quality of the neighborhood. The mean importance rating for the "package of energy features," although lower than most other features listed, is positive at 3.56 on a 1-to-5 scale. The "package of energy features" had a higher mean importance rating than solar water heating (3.49) or availability of PV system (3.34 on a 1-to-5 scale). A majority of SheaHomes buyers (58%) indicate that the package of energy features was important or very important in their purchase decision; 52% indicate that the availability of solar water heating was important or very important in their purchase decision, and 49% indicate that the availability of solar PV was important or very important in their decision.

The sense of the responses seems to be that the energy features were "icing on the cake" for most of the SheaHomes buyers.

Seventy-seven percent of comparison buyers indicate they visited SheaHomes while they were shopping for their new homes; however, a majority of 57% of comparison buyers indicate they were *unaware* of the homes' energy features.

6. *Should solar features be standard or optional? Are optional upgrades a good idea?*

   As discussed earlier, our research suggests that solar PV systems of at least 2.4-kW should be standard, and optional upgrades are not a good idea because they complicate the transaction.

7. *How are ZEH purchasers different from purchasers of conventional homes in motivation, attitudes, and demographics?*

   In general, purchasers of high-performance homes are upscale, and they are not different from purchasers of upscale conventional homes in motivation, attitudes, and demographics.

8. *Among energy features, which are the most important to homebuyers—efficiency features, solar water heating systems, or solar electric systems? Which feature has the most appeal? Or does an integrated ZEH with all features have the most draw?*

   The package of energy features including the PV system appears to have the most appeal. PV buyers give a mean importance rating relative to their purchase decision of the package of energy features as 3.75 on a 1-to-5 scale and the availability of PV systems as 3.60. These mean scores are significantly higher than those of all main owners, and even more so than those of main owners who were offered PV systems and chose not to purchase them.

9. *Is aesthetics a barrier? Is it positive, negative, or neutral? How important was it in the purchase decision? Does it matter if solar equipment is on the front or back of the house?*

   Neither the qualitative nor the quantitative studies identified aesthetics as a barrier to high-performance ownership. However, because the study is of homeowners who bought these homes, it cannot be concluded that no one objects to the aesthetics of high-performance homes. It seems fair to conclude that the market is large enough that it does not matter if some people object. Plenty of buyers do not object. No one mentioned a problem with the placement of the PV systems, and the solar water preheating systems look like a pleasant skylight.

10. *How important is the feedback device (showing the amount of electricity the house is using and the amount the PV systems is producing)?*

    The feedback device is very useful to PV owners. This device is the link between PV technology and the home's occupants that results in the interaction effects discussed above. The digital display shows owners how and when they are using electricity, permitting them a modicum of control over task scheduling. They use it to monitor if appliances or lights have been left on as they are leaving the house so they can turn them off. They report that they

change their behavior because of this device. Without it, PV owners would have no way to monitor their electricity production and consumption in real time. We conclude that the digital display, showing both production and consumption of electricity, is *critical* in optimizing the interaction between ZEH technology and energy-consuming behavior.

11. How satisfied are customers with their home purchases?

Most buyers are satisfied with their new homes, but SheaHomes buyers, and especially PV buyers, are more satisfied than are comparison buyers. Several pieces of evidence in the study support this conclusion.

Summary Remarks

These findings and conclusions are believed to be valuable to builders, policy-makers, utility companies, trade and professional organizations, and the energy-efficiency and solar-energy communities, as well as to marketers, researchers and energy analysts, and homebuyers. Recommendations for some of these groups are discussed in the next chapter.

In conclusion, this study is replete with findings that support the rapid development of high-performance homes with PV systems, near-ZEHs, and ZEHs. Once offered standard, the costs of these homes to the builder appear to be manageable, the product provides differentiation on the market, and ordinary homebuyers want to buy these homes. Once they live in them, homeowners become even more enthusiastic. Policies that support the deployment of ZEHs, such as net-metering legislation, simplified interconnectivity agreements, building codes and standards, utility rebates, and subsidies for solar water heating and PV systems, will be rewarded by rapid diffusion of an idea whose time has come.

EXHIBIT D

Rick Nevin and Gregory Watson

Evidence of Rational Market Valuations for Home Energy Efficiency

According to this study, residential real estate markets assign to energy-efficient homes an incremental value that reflects the discounted value of annual fuel savings. The capitalization rate used by homeowners was expected to be 4%–10%, reflecting the range of after-tax mortgage interest rates during the 1990s and resulting in an incremental home value of $10 to around $25 for every $1 reduction in annual fuel bills. Regression analysis of American Housing Survey data confirms this hypothesis for national and metropolitan area samples, attached and detached housing, and detached housing subsamples using a specific fuel type as the main heating fuel.

Investments in high-efficiency heating and air conditioning equipment, insulation, and other energy-efficient home features have historically been justified and promoted based on the investment payback to the homeowner. The payback period is the number of years needed to fully recover energy efficiency investments through reduced fuel costs. More recently, the U.S. Environmental Protection Agency initiated a marketing program called "ENERGY STAR Homes." This effort teaches that energy-efficient homes produce immediate positive cash flow for home buyers because the reduction in monthly fuel bills more than offsets the higher monthly mortgage payment needed to finance such investments. Some home buyers, however, still hesitate to invest in energy efficiency because they are uncertain that they would stay in their homes long enough to recover their investment through lower fuel bills and that they could recover an investment in energy efficiency when they sell their homes. Standard underwriting criteria for home mortgages can also increase the down payment requirements or mortgage insurance

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costs on these homes because energy efficiency investments raise the upfront price of a new home. Underwriting criteria may even prevent home buyers from qualifying for mortgages if the appraised value of the home does not fully reflect the value of energy efficiency investments. Home appraisals may not always reflect the cost of energy efficiency investments because research has never clearly demonstrated or quantified the relationship between energy efficiency and market value.

Underwriting criteria may prevent home buyers from qualifying for mortgages if the appraised value of the home does not fully reflect the value of energy efficiency investments.

ENERGY-EFFICIENT HOMES AND STANDARD MORTGAGE UNDERWRITING CRITERIA

Even if energy-efficient home investments pay for themselves in energy savings, the cost of such investments can adversely affect the qualifying ratios for a home mortgage, including the front-end and back-end income ratios and the loan-to-value ratio. The front-end ratio (or housing-cost-to-income ratio) is monthly housing expenses (principal, interest, taxes, and insurance, or PITI) divided by gross monthly income. The back-end ratio (or total debt-to-income ratio) is total monthly obligations (including auto loans, for example) divided by gross monthly income. The loan-to-value ratio is the amount of the mortgage divided by the lower of the appraised value or price of the home.

Standard underwriting criteria for 30-year, fixed-rate mortgages include a 28% constraint for the front-end ratio and a 36% constraint for the back-end ratio. Neither of these standard criteria account for utility costs as part of monthly housing expenses (PITI) or total monthly obligations. Therefore, the cost of energy-efficient upgrades for a new home can increase the home buyer's monthly PITI or total obligations beyond the qualifying constraints, even when the savings in monthly fuel bills more than offsets the higher mortgage interest. This income ratio anomaly was substantially addressed when the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac) responded to the energy crises of the 1970s by establishing energy-efficient mortgage (EEM) guidelines that allow for a "2% stretch" over normal income ratio criteria for energy-efficient home mortgages.[1] The 2% stretch means that the front-end ratio for an EEM is raised to 30%, and the constraint for the back-end ratio is raised to 38%. For a household earning $60,000 per year, the 2% stretch can accommodate up to about $100 per month for higher mortgage payments related to cost-effective energy efficiency upgrades.

The 2% stretch gives lenders more flexibility with income ratios for energy-efficient homes but does not allow any flexibility with the loan-to-value ratio. Home buyers generally must pay for mortgage insurance to qualify for a 30-year fixed-rate mortgage with a loan-to-value above 80%. They also pay higher rates for mortgage insurance if their loan-to-value exceeds 90%, and often cannot qualify for the mortgage if their loan-to-value exceeds 95%. For a typical $160,000 house, an 80% loan-to-value loan requires 20% down, or $32,000, resulting in a mortgage loan amount of $128,000. If $5,000 of energy-efficient upgrades are included in the purchase of the home, the price increases to $165,000, and a higher down payment is needed to maintain the same loan-to-value ratio. At best, if the appraised value for the home is $165,000, the home buyer must add $1,000 to the down payment to maintain an 80% loan-to-value. At worst, if the appraiser does not recognize any additional value for energy efficiency and estimates the appraised value at $160,000, then the home buyer must add the entire $5,000 to the down payment in order to maintain the 80% loan-to-value.

The Federal Housing Administration (FHA) offers an EEM that allows the incremental cost of energy-efficient, cost-effective upgrades to be added directly to the mortgage, as long as these additional costs do not exceed the greater of $4,000 or 5% of the property's value (not to exceed $8,000). The FHA EEM is designed so that someone who qualifies to buy a home without energy efficiency investments would also qualify for the FHA EEM without any increase in the required down payment. The FHA EEM defines "cost effective" to include energy efficiency investments with a total cost that is less than the present value of the energy saved over the useful life of the investment.

1. William Prindle, "Energy-Efficient Mortgages: Proposal for a Uniform Program," 1990 Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy, Washington, D.C., August 1990, 7.155.

This EEM, however, is subject to the FHA maximum single-family mortgage limits, which can be as low as $86,317 and go up to $170,362.

Fannie Mae and Freddie Mac are currently engaged in pilot programs that allow the incremental cost of energy-efficient, cost-effective upgrades to be added to the appraised value of a home. Under these programs, the home buyer must provide only the additional down payment associated with the increase in appraised value in order to maintain the same loan-to-value ratio (e.g., an additional $1,000 down with a $5,000 upgrade to maintain an 80% loan-to-value). The Fannie Mae and Freddie Mac EEMs would provide substantial relief from loan-to-value constraints on energy-efficient homes that exceed FHA limits, but these programs are not generally available outside the pilot program areas at this time.

Review of Literature on Market Valuation of Energy-Efficient Homes

Seven studies provide some insight into the relationship between residential housing values and energy costs (see table 1). Six of these studies were published between 1981 and 1986, and the most recent study was published in 1990. The data for these studies were collected over a time period of considerable variation in fuel prices and mortgage interest rates. The first four studies are also not directly comparable because some drew relationships between home value and fuel type, while others linked home value to specific energy efficiency characteristics (e.g., the amount of insulation).

The research results are qualified by sample size limitations, narrow regional or local data sets, and/or the absence of data on key regression variables affecting residential housing values. It is significant, however,

TABLE 1 Published Research on Market Value of Energy-Efficient Homes

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 65° 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 at after-tax mortgage interest rate.

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

b John B. Corgel, Paul R. Geobel, 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 Hossein Haeri, "Economic Efficiency v. Energy Efficiency," *Energy Economics* (April 1990): 122–131.

Although home buyers are not likely to make present-value calculations or fuel bills, they will look at average fuel bills and energy efficiency features before buying a home.

that all seven studies report higher home values associated with energy efficiency. Comparable results shown for the last three studies suggest that home value increases by $11–$21 for every dollar reduction in annual fuel expenditures. The last study also suggests consistent criteria that could be used in home appraisals to quantify the increase in market value associated with energy efficiency. Specifically, the higher market value associated with energy efficiency in this study appears to reflect projected fuel savings discounted at the home buyer's after-tax mortgage interest rate.

Rational Market Hypothesis

The hypothesis presented here is that rational home buyers should bid more for energy-efficient homes as long as the incremental cost of the energy-efficient home does not exceed the present value of its expected fuel savings. Further, the discount rate used to determine the present value of expected fuel savings should be the home buyer's after-tax mortgage interest rate.

Throughout the 1990s, the interest rate on 30-year fixed-rate mortgages has ranged from just under 7% to just over 9%. A home buyer paying a 7% mortgage rate and using the mortgage interest deduction in the top marginal income tax bracket will pay an after-tax interest rate of approximately 4%. At the other extreme, home buyers with a 9% mortgage rate could pay a total financing cost of almost 10% if they pay an additional percentage rate for mortgage insurance and cannot benefit from the mortgage interest deduction (because their standard deduction exceeds their itemized deductions). Using the range of 4%–10% for after-tax interest rates, the hypothesis for the regression analysis can be stated as follows:

> *With after-tax interest rates between 4%-10% and stable fuel price expectations, home buyers should pay $10-$25 more for every dollar reduction in annual fuel bills resulting from energy efficiency.*

If home buyers expect stable fuel prices, then paying $10 for every $1 reduction in annual fuel bills is an energy efficiency investment having a 10% return, and paying $25 per $1 reduction in annual fuel bills yields a 4% return. Although home buyers are not likely to make present-value calculations on fuel bills, they are likely to look at average fuel bills before buying a home and obtain information about insulation and other energy efficiency features. Fuel costs may be considered just one of many complex factors affecting the decision to buy a home, but the same can be said about other determinants of home value—from number of bedrooms to the quality of local schools. In a rational, competitive market, the value of energy efficiency, like the value of any other housing characteristic, should reflect its marginal value to home buyers. If home buyers expect stable fuel prices, then the marginal value of energy efficiency in recent years should be $10–$25 for every dollar reduction in annual fuel bills.

Data

The rational market hypothesis was tested for energy-efficient home values using 1991, 1993, and 1995 American Housing Survey (AHS) national data, and for 1992 through 1996 metropolitan statistical area (MSA) data. The AHS is a unique data source for this research in that it includes both house characteristic data (home value, number of rooms, square feet, lot size, and other key housing characteristics) as well as utility expenditure data. These data are reported by homeowners in lengthy interviews with the Census Bureau. Although independent data measurement (e.g., actual sales prices for homes) is preferable to self-reported values, the AHS provides a relatively large sample to ease concerns about random reporting error. Further, the AHS includes Census Bureau weights indicating the universe of owner-occupied housing units represented by each sample unit.

A complete set of national AHS data is collected every two years, while the MSA data are collected on a staggered cycle. The national sample includes data on rural housing not included in the MSA data and non-MSA urbanized areas, but the MSA data provides larger sample sizes within each specified MSA. The MSA data also provides a completely separate set of survey respondents (i.e., there is no overlap with the national sample). The period 1992–1996 reflects a complete cycle of MSA surveys, with a few MSAs surveyed in both 1992 and 1996. The MSA analysis here examines each of these five years of data and a merged MSA sample, including the complete cycle of MSA surveys. In the case of the few MSAs surveyed in both 1992 and 1996, the merged sample includes only the 1996 data.

For each national and MSA sample, the analysis examined subsets of the weighted AHS data on owner-occupied housing in adequate condition reporting electricity, piped gas, or fuel oil as the main heating fuel. The 8% of housing units using wood and other fuel types were excluded from the analysis because they provided incomplete data on fuel expenditures. Rental units were excluded because survey data on property values and fuel expenditures for rental units are probably distorted by reporting errors. Units in "adequate condition" are defined by the Census Bureau as having none of a series of major flaws or some combination of moderate flaws that make the unit substandard in quality. Substandard units were excluded from the analysis. These include houses experiencing electricity and heating equipment failure, which could obviously lower total fuel bills. Even when units were classified as substandard for another reason, their low fuel bills were attributed to uncomfortable internal temperatures.

The AHS data were separated into detached housing and attached housing to account for differences in their valuation models and consumption patterns. The detached housing sample was large enough to permit the analysis of homes in each category of main heating fuel (electricity, piped gas, or fuel oil). This further segmentation was intended to reveal any variation by fuel type.

Model Specification

Table 2 lists the variables in the regression model for single-family detached home values in the national AHS sample. Beside each independent variable description is the expected sign of the coefficient; also, the range anticipated by the hypothesis for the total utility variable is shown.

Established indicators of home value. The model incorporates independent variables for lot size, unit square feet, age of unit, and number of rooms, plus dummy variables to indicate whether the unit has a porch (or deck, balcony, or patio), garage (or carport), and/or central air conditioning. The coefficients for lot size, unit square feet, and number of rooms are all expected to be positive because home buyers are expected to pay more for additional living space. The coefficients for porch, garage, and central air conditioning are also expected to be positive because home buyers are expected to pay more for these amenities. Finally, the coefficient for age is expected to be negative be-

TABLE 2 Variables in Regression Model for Detached Home Values

Variable	Variable Description	Expected Value
House Value	This is the owner's reported value of the house. It is not the purchase price, nor is it the assessment for tax purposes.	Dependent variable
Intercept	Constant/intercept.	
Lot	Lot size in square feet.	+
Age	Age of property in years.	−
UnitSf	Size of unit in square feet.	+
Rooms	Number of rooms.	+
Totutil	Sum of reported household expenditures on fuel oil, gas, and electricity, including the total consumption of these fuels (There is no way to distinguish how much electricity was used for heating and cooling as opposed to lighting and other electricity consumption.).	-10 to -25
Lot2-MM	Lot size square feet squared, in millions.	−
Unitsf2-K	Size of unit square feet squared, in thousands.	−
SFUtil-K	Unit square feet multiplied by total utility, in thousands. This is to account for more space requiring more utility consumption.	+
RMUtil	Number of rooms multiplied by total utility. This is to account for more rooms requiring more utility consumption.	+
Garage	Whether or not a garage or carport was present.	+
Porch	Whether or not a porch or deck was present.	+
AirCond	Whether or not the house had central air conditioning.	+
South	If unit is in the South.	
West	If unit is in the West.	
Midwst	If unit is in the Midwest.	
Urban	If unit is in an urbanized area but not inside the central city.	
Rural	If unit is in a rural area.	

cause home buyers are expected to pay less for older homes.

Second derivative variables. The model incorporates variables for the squared values of lot size and unit square feet. Negative coefficients are anticipated for these variables due to diminishing marginal values for additional space.

Total annual fuel expenditures. The rational market hypothesis anticipates a negative coefficient for total annual fuel expenditures. Further, the expected value for this coefficient is between -10 and -25, indicating that home values decreased by $10–$25 for every dollar increase in annual fuel bills.

Fuel interaction variables. Two independent variables are included in the model to account for the interactions between fuel costs and living space (measured by square feet and number of rooms). The room utility variable was constructed by multiplying the number of rooms in a house by its annual fuel bill, and the square feet utility variable was constructed by multiplying the housing unit's square feet by its annual fuel bill. The inclusion of these variables in the model is intended to isolate the effect of energy efficiency in the coefficient for total annual fuel expenditures. For houses with equal living space, home buyers are expected to pay more for homes with lower fuel bills, but the two interaction variables are included to control for larger homes that have higher utility bills because they have more interior space. The expectation of positive signs for these two fuel interaction variables is that the preference for more space is generally stronger than the preference for lower utility bills.

Location variables. The model incorporates two types of location dummy variables: one set identifies region (the omitted category is the Northeast) and the other set defines urban status (the omitted category is Central City). Both the region and urban status categories are as defined by the Census Bureau.

Attached housing model. The attached housing model is exactly the same as the detached housing model, except that the lot size and lot squared variables are not included in the attached housing model because a substantial majority of the attached housing units in the AHS do not report any values for lot size.

MSA model. The attached and detached housing models for the MSA data are the same as the national AHS model, except that the location variables are dummy variables for each specific MSA.

Regression Results for Relationship Between Fuel Expenditures and Home Values

Table 3 shows the total utility coefficients from each of 15 national AHS regressions examining detached homes, attached homes, and the subsets of detached homes reporting their main heating fuel as electric, piped gas, and fuel oil. The total utility coefficients from the 30 MSA regressions are shown in table 4. Table 5 provides the approximate sample sizes for each type of AHS sample and subsample examined in the analysis, and table 6 shows the approximate R^2 values for the regressions associated with each type of sample and

TABLE 3 Total Utility Coefficients in National AHS Home Value Regressions

	1995	1993	1991
Detached homes	-23.41***	-20.00***	-21.16***
Attached homes	-20.49	-12.34	-18.88
Detached electric homes	-16.42**	-31.43***	-28.55***
Detached piped gas homes	-28.94***	-22.48***	-36.25***
Detached fuel oil homes	-21.92***	-5.05	+6.04

***Significance > 99%; ** significance > 95%.

TABLE 4 Total Utility Coefficients in MSA Home Value Regressions

	1996	1995	1994	1993	1992	1992–1996
Detached homes	-9.92***	-22.44***	-30.89***	-10.40**	-26.38***	-17.68***
Attached homes	-20.69	-15.35	-35.65**	-25.85	16.50	-23.18***
Detached electric homes	-36.73***	-12.53*	-33.66***	-13.11	-20.64**	-28.60***
Detached piped gas homes	-6.79*	-26.65***	-27.65***	-24.43***	-33.97***	-20.29***
Detached fuel oil homes	-10.07	-30.44**	-20.07	12.31	6.61	-2.64

*** significance > 99%, ** significance > 95%, * significance > 90%.

TABLE 5 Approximate Sample Sizes for AHS Regressions

	National	MSA	Merged MSA
Detached homes	16,000	10,000	46,000
Attached homes	800	600	3,000
Detached electric homes	3,600	2,000	9,000
Detached piped gas homes	10,000	7,000	32,000
Detached fuel oil homes	2,400	1,000	5,000

TABLE 6 Approximate R^2 Values for AHS Regressions

	National	MSA	Merged MSA
Detached homes	0.41	0.55	0.59
Attached homes	0.28	0.47	0.53
Detached electric homes	0.38	0.55	0.58
Detached piped gas homes	0.43	0.57	0.61
Detached fuel oil homes	0.40	0.48	0.50

subsample (exact sample sizes and R^2 values vary by year). Detailed regression results for the national AHS data and the MSA regressions are available from the authors.

Discussion of Results

Forty-five regressions were conducted. All F values exceed the 99% level of significance. In the larger sample size regressions, almost all of the coefficients have the expected signs, and most are significantly different from zero at the 99% level. The limitations of the AHS data are reflected in R^2 values for the national sample regressions of about 0.40. This is not surprising because the AHS does not provide data that quantifies neighborhood crime rates or public school rankings, which certainly affect home price variations across different neighborhoods. Also, the variable in the national sample regression for urban status (urban, rural, or central city) provides only a discrete indicator variable to reflect the extent to which real estate values tend to increase in a continuous fashion for housing units closer to the city center. The region variable is also a discrete indicator variable that does not capture the extent of home value variation associated with different metropolitan areas within a region. Despite these limitations on the model's specification, the relatively large sample size from the AHS results in estimated values and the standard errors for the fuel expenditure coefficients that provide strong support for the rational market hypothesis.

The results for the MSA regressions confirm the findings from the national sample regressions. The R^2 values for the MSA regressions are also higher than the R^2 values for the national sample, with an R^2 value as high as 0.61 for the merged MSA regression for detached homes with piped gas. The higher R^2 values for the MSA regressions suggest that the dummy variables for each MSA capture more of the "location" value in residential real estate than the combination of region and urban status variables in the national sample. The remaining unexplained variance in the MSA regressions almost certainly reflects the importance of other more complex location variables (local schools, crime, and length of work commute) that are known to affect home values but are not detailed in the AHS data.

Beyond showing that the total utility coefficient is significantly different from zero, the MSA and national AHS regressions are remarkably consistent with respect to the specific value assigned to the total utility coefficient. For both the MSA and national samples, the total utility coefficients for attached and detached homes are very similar, with an average value of about -20, indicating that home buyers during this period discounted their future fuel savings at after-tax mortgage interest rates of about 5%. The smaller samples show more variation, but about half of the 45 regressions have total utility coefficients within one standard error of -20, consistent with random error around a normal distribution mean of –20. These findings provide strong evidence that the market value of energy-efficient homes reflects projected fuel savings discounted at the average home buyer's after-tax mortgage interest rate.

Detached Home National Samples

All three of the larger national samples for detached homes show total utility coeffi-

Home buyers in the 1990s have recognized market value for energy efficiency based on annual fuel savings discounted at 5% after-tax mortgage interest rate.

cients between -20 and -24, at the upper end of the range of -10 to -25 anticipated by the rational market hypothesis. Further, standard errors for these fuel expenditure coefficients are between 3.0 and 3.4, indicating a high probability that the true value of this coefficient is not only greater than zero but specifically in the upper end of the range anticipated by the hypothesis. The smaller single-year MSA samples for detached homes show more variation, but all five of these samples show total utility coefficients within or just outside of the anticipated range of -10 to -25, with a coefficient of -18 for the larger merged MSA sample.

Attached Home National Samples

The statistical significance of the results for the attached home national samples and single-year MSA samples are limited by small sample sizes, but the values for their total fuel expenditure coefficients are completely consistent with the detached housing analysis. The value of this coefficient in the larger merged MSA sample is -23, with a standard error of 8.3. This consistency in the fuel expenditure coefficients for attached and detached housing contrasts with two significant differences between these two housing types. First, the attached housing model has no independent variable for lot size. Second, the coefficients for the unit square feet variables indicate that the incremental market value associated with more living space is higher for attached homes than for detached homes, consistent with the fact that attached housing is disproportionately located closer to central cities where real estate values are higher.

In spite of the significant differences between attached and detached housing markets, the rational market hypothesis anticipates little or no difference in the fuel expenditure coefficient because the discounted value associated with every dollar reduction in annual utility bills should not be affected by other housing characteristics. Therefore, the consistency of the fuel expenditure coefficients in the attached and detached housing regressions is entirely supportive of the hypothesis.

Electric-Heat Detached Home National Samples

Regression analyses for the subset of detached housing units that identify electricity as their main heating fuel show national sample coefficients for the fuel expenditure variable that range from -16 to -31, with standard errors between 6.4 and 7.4. The smaller single-year MSA samples result in more variation in the total fuel expenditure coefficients for these samples, but these values are all roughly consistent with the hypothesis. The value of this coefficient in the larger merged MSA sample is -28.6, with a standard error of 3.9. Almost all of the national and MSA regressions show total fuel expenditure coefficients for electric homes within one standard error of the upper end of the -10 to -25 range anticipated by the rational market hypothesis, consistent with the results for all detached housing analysis. These consistent results for the electric home subsamples suggests that the market value associated with lower fuel expenditures does not simply reflect a premium paid for homes with a fuel type that may be more economical than other heating fuels in certain regions.

Gas Heat Detached Home Samples

The regression analyses for homes that identify piped gas as their main heating fuel reinforce the conclusions suggested by the analysis of electric homes. In the national sample regressions, the fuel expenditure coefficients range from -22 to -36, with standard errors between 4.0 and 4.6. The 1991 coefficient is the only estimate that is more than one standard error above the range anticipated by the rational market hypothesis, possibly reflecting the preference for gas heat over fuel oil following the spike in fuel oil prices in 1990. A similar pattern appears in the single-year MSA regressions. The larger merged MSA sample shows a fuel expenditure coefficient of -20, with a standard error of just 2.5, consistent with the results for all detached housing. These results indicate that the incremental home value of $20 per dollar reduction in annual fuel expenditures is evident both within and across subsets of housing using different fuel types as their main heating fuel.

Fuel Oil Heat Detached Home National Samples

The regression results for detached homes with fuel oil heat reflect the relatively small size of this subsample and appear to be distorted by extreme fluctuations in fuel oil prices in the early 1990s. Detailed results for this subsample show that some coefficients are not significantly different from zero and/or do not have the expected signs, especially in the

regression analysis for the 1991 data. The 1995 coefficient for the fuel expenditure variable is -21, consistent with results for other fuel types, but the 1993 coefficient is -5, and the 1991 coefficient is +6. Also, the coefficient for unit square feet in the 1991 fuel oil regression is negative. Similar patterns are reflected in the MSA regressions, with positive values for the fuel expenditure coefficients in 1992 and 1993.

The anomalous results in the fuel oil regressions for the early 1990s almost certainly reflect the extreme spike in fuel oil prices following the invasion of Kuwait in the summer of 1990. AHS respondents in the 1991 survey were reporting annual fuel bills that reflected extraordinarily high fuel oil prices during the 1990–1991 winter. Further, the national AHS sample of detached homes reporting fuel oil as their main heating fuel declined by almost 30% between the 1991 and 1995 surveys, while the sample size for all detached homes declined by only 2% between these two samples. This finding suggests that a large percentage of homes with fuel oil heat were converted to gas or electric heat in the years following the 1990 spike in fuel oil prices. Homeowners with the most financial incentive for converting from fuel oil and those most likely to have the financial means to convert would tend to be upper-income households disproportionately concentrated in larger homes with higher property values. Because the 1991 survey was actually conducted from July 1991 through December 1991, a substantial number of households may have reported higher home values in 1991 based on fuel conversions that were already planned or underway. These same households, however, may have reported their main heating fuel and annual fuel expenditures based on the spike in fuel oil prices from the previous winter. These factors could have substantially distorted the regression results for this subsample in the early 1990s.

CONCLUSION

The 45 regressions collectively indicate a clear convergence for the value of home energy efficiency. Almost half of the fuel expenditure coefficients are within one standard error of -20. This suggests that home buyers in the 1990s have recognized market value for energy efficiency based on annual fuel savings discounted at a 5% after-tax mortgage interest rate. The major exception to these findings were the regressions for homes heated by fuel oil in the early 1990s. These outliers appear to reflect the sharp increase in fuel oil prices in 1990 and conversions to gas heat in subsequent years.

The convergence of the fuel expenditure coefficients around -20 is consistent with research findings that the selling price of homes increased by $20.73 for every $1 decrease in annual fuel bills.[2] Other research supports the underlying conclusion that energy efficiency increases home value by an amount that reflects annual fuel savings discounted at the prevailing after-tax mortgage interest rate.[3]

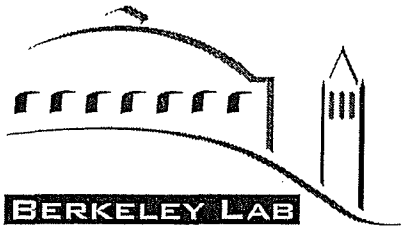
The implication for home buyers is that they can profit by investing in energy-efficient homes even if they do not know how long they might stay in their homes. If their reduction in monthly fuel bills exceeds the after-tax mortgage interest paid to finance energy efficiency investments, then they will enjoy positive cash flow for as long as they live in their homes and can also expect to recover their investment in energy efficiency when they sell their homes.

The implication for appraisers is that cost-effective energy efficiency investments *do* appear to be reflected in residential housing market values. Therefore, the appraised value of energy-efficient homes could understate their actual resale value if the comparables used in the appraisal do not reflect the value of a cost-effective energy efficiency investment.

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

3. Marvin J. Horowitz and Hossein Haeri, "Economic Efficiency v. Energy Efficiency," *Energy Economics* (April 1990): 122–131.

EXHIBIT E



ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY

REPORT LBNL-4476E

An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California

Ben Hoen, Ryan Wiser, Peter Cappers, and Mark Thayer

Environmental Energy Technologies Division

April 2011

The report can be downloaded from: http://eetd.lbl.gov/ea/emp/reports/lbnl-4476e.pdf

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Research Report Summary

An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California

Background

The market for photovoltaic (PV) energy systems is expanding rapidly in the U.S. Almost 100,000 PV systems have been installed in California alone, more than 90% of which are residential. Some of those "PV homes" have sold, yet little research exists estimating if those homes sold for significantly more than similar non-PV homes. A clearer understanding of these effects might influence the decisions of homeowners considering installing PV on their home or selling their home with PV already installed, of home buyers considering purchasing a home with PV already installed, and of new home builders considering installing PV on their production homes.

To determine whether PV homes sell for significantly more than comparable non-PV homes, Berkeley Lab analyzed a dataset of approximately 72,000 California homes, almost 2,000 of which had PV systems installed at the time of sale. The study also investigated whether premiums for PV installed on new homes were different than those for PV installed as a retrofit on existing homes, and whether the age or the size of the PV system impacted premiums.

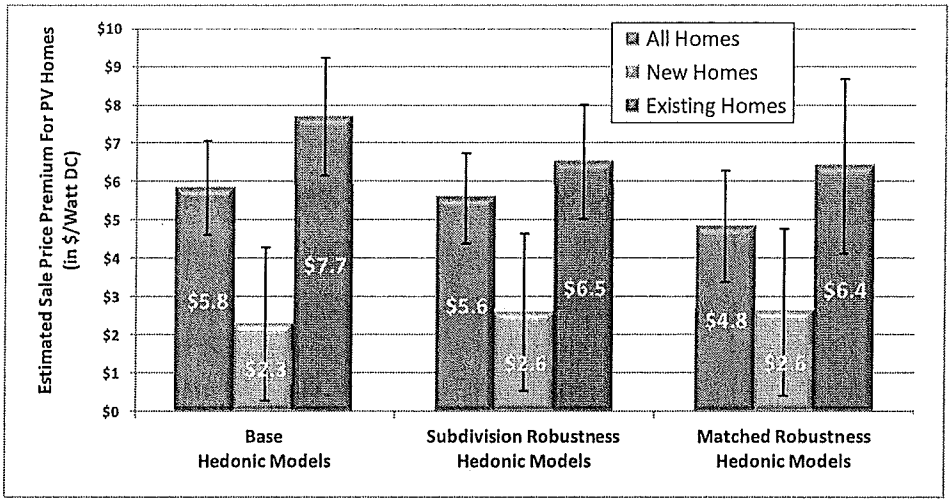
A large number of hedonic pricing and difference-in-difference models (see sidebar on next page) were used to ensure that the results were robust.

Results

The research finds strong evidence that homes with PV systems in California have sold for a premium over comparable homes without PV systems. More specifically, estimates for average PV premiums among a large number of different model specifications coalesced near $17,000 for a relatively new "average-sized" - based on the sample of homes studied - PV system of 3,100 watts (DC). This corresponds to an average home sales price premium of $5.5/watt (DC), with the range of results across various models being $3.9 to $6.4/watt.

These results are similar to the average increase for PV homes found by Dastrop et al. (2010), which used similar methods but focused on homes in the San Diego area. The average sales price premiums also appear to be comparable to the investment that homeowners have made to install PV systems in California (after applicable state and federal incentives), which from 2001-2009 averaged approximately $5/watt (DC) (Barbose et al., 2010), and homeowners with PV also benefit from electricity cost savings after PV system installation and prior to home sale.

When the dataset is split between new and existing homes, PV system premiums are found to be markedly affected (see figure on back), with new homes with PV demonstrating average premiums of $2.3 to 2.6/watt, while the average premium for existing homes with PV being more than $6/watt. The report offers a number of possible explanations for why this disparity might exist, including differences in the underlying net installation costs for PV systems between new and existing homes. Additionally, new home builders may gain value from PV as a market differentiator, and have therefore often tended to sell



PV as a standard (as opposed to an optional) product on their homes and perhaps been willing to accept a lower premium in return for faster sales velocity and decreased carrying costs.

The research also finds that, as PV systems age, the premium enjoyed at the time of home sale decreases, indicating that buyers and sellers of PV homes may be accounting for the decreased efficiency and remaining expected life of older PV systems.

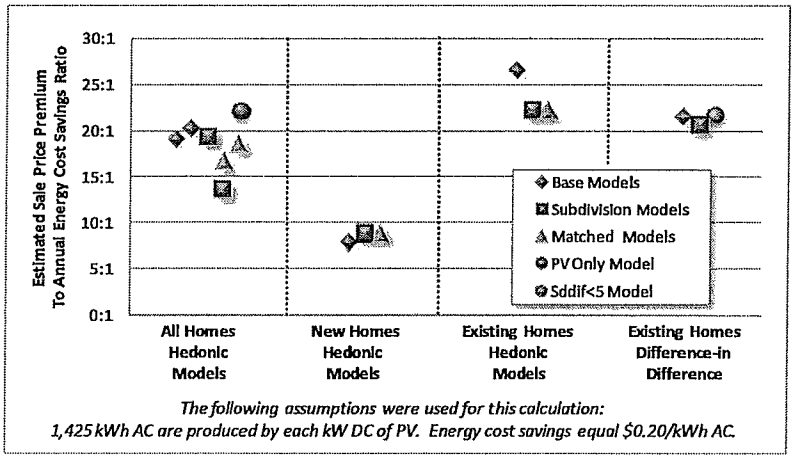
When the results are expressed as a ratio of the sales price premium to estimated annual electricity cost savings associated with PV (see figure below) they are consistent with those of the more-extensive existing literature on the impact of energy efficiency on home sales prices; the present research finds an averages range from 7:1 to 31:1, with models coalescing near 20:1.

Applicability

Although this research finds strong evidence that homes with PV systems in California have sold, on average, for a significant premium over comparable homes without PV systems, the authors recommend that extrapolation of these results to different locations or market conditions be done with care.

Further Research Warranted

The report outlines a number of additional questions that warrant further research, such as investigating more-recent home sales (the report's dataset spanned 1999 thru 2009) from a broader geographic area (the dataset included only California homes), and further investigating the difference in premium between new and existing PV homes.



The following assumptions were used for this calculation:
1,425 kWh AC are produced by each kW DC of PV. Energy cost savings equal $0.20/kWh AC.

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Dastrop, S., Zivin, J. G., Costa, D. L. and Kahn, M. E. (2010) Understanding the Solar Home Price Premium: Electricity Generation and "Green" Social Status. UC Center for Energy & Env. Econ., Berkeley, CA. Dec 9, 10. WP-001.

Barbose, G., Darghouth, N. and Wiser, R. (2010) Tracking the Sun III: The Installed Cost of Photovoltaics in the U.S. 1998-2009. LBNL, Berkeley, CA. Dec, 10. LBNL-4121E.

What Is a Hedonic Pricing Model?

Hedonic pricing models are frequently used by real estate professionals and academics to assess the impacts of individual house and community characteristics on property values by investigating the sales prices of homes. A house can be thought of as a bundle of characteristics (e.g., number of square feet). When a price is agreed upon between a buyer and a seller there is an implicit understanding that those characteristics have value. When data from a large group of residential transactions are available, the average marginal contribution to the sales price of each characteristic can be estimated with a regression model. The contribution to the selling price of having a PV system can be thus be estimated, if other important housing market influences are adequately controlled for.

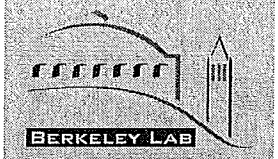
What Is a Difference-in-Difference Model?

A variant of the hedonic model, a difference-in-difference model compares inflation adjusted selling prices of homes that have sold twice, both before a condition exists (e.g., having a PV system installed) and after.

What Are Robustness Models?

Because models are built on assumptions, practitioners often test those assumptions by trying multiple model forms. In this research, "base" models, which used the full dataset and controlled for "neighborhood" effects at the census block group level, were compared with "robustness" models. Examples include models that controlled for "neighborhood" at the subdivision level (a potentially better proxy than the block group), models that "matched" PV and non-PV homes to be statistically identical in many respects (similar to what an appraiser might do when valuing a home), and models that only evaluated PV homes.

The general consistency in results across all of the models demonstrates the robustness of the study's findings.



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Disclaimer

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Abstract

An increasing number of homes with existing photovoltaic (PV) energy systems have sold in the U.S., yet relatively little research exists that estimates the marginal impacts of those PV systems on home sales prices. A clearer understanding of these effects might influence the decisions of homeowners considering installing PV on their home or selling their home with PV already installed, of home buyers considering purchasing a home with PV already installed, and of new home builders considering installing PV on their production homes. This research analyzes a large dataset of California homes that sold from 2000 through mid-2009 with PV installed. Across a large number of hedonic and repeat sales model specifications and robustness tests, the analysis finds strong evidence that California homes with PV systems have sold for a premium over comparable homes without PV systems. The effects range, on average, from approximately $3.9 to $6.4 per installed watt (DC) of PV, with most coalescing near $5.5/watt, which corresponds to a home sales price premium of approximately $17,000 for a relatively new 3,100 watt PV system (the average size of PV systems in the study). These average sales price premiums appear to be comparable to the investment that homeowners have made to install PV systems in California, which from 2001 through 2009 averaged approximately $5/watt (DC), and homeowners with PV also benefit from electricity cost savings after PV system installation and prior to home sale. When expressed as a ratio of the sales price premium to estimated annual electricity cost savings associated with PV, an average ratio of 14:1 to 22:1 can be calculated; these results are consistent with those of the more-extensive existing literature on the impact of energy efficiency (and energy cost savings more generally) on home sales prices. The analysis also finds - as expected - that sales price premiums decline as PV systems age. Additionally, when the data are split between *new* and *existing* homes, a large disparity in premiums is discovered: the research finds that *new* homes with PV in California have demonstrated average premiums of $2.3-2.6/watt, while the average premium for *existing* homes with PV has been more than $6/watt. One of several *possible* reasons for the lower premium for new homes is that new home builders may also gain value from PV as a market differentiator, and have therefore often tended to sell PV as a standard (as opposed to an optional) product on their homes and perhaps been willing to accept a lower premium in return for faster sales velocity. Further research is warranted in this area, as well as a number of other areas that are highlighted.

5. Conclusions

The market for solar PV is expanding rapidly in the U.S. Almost 100,000 PV systems have been installed in California alone, more than 90% of which are residential. Some of those "PV homes" have sold, yet little research exists estimating if those homes sold for significantly more than similar non-PV homes. Therefore, one of the claimed incentives for solar homes - namely that a portion of the initial investment into a PV system will be recouped if the home is sold – has, to this point, been based on limited evidence. Practitioners have sometimes transferred the results from past research focused on energy efficiency and energy bills more generally and, while recent research has turned to PV that research has so far focused largely on smaller sets of PV homes concentrated in certain geographic areas. Moreover, the home sales price effect of PV on a *new* versus an *existing* home has not previously been the subject of research. Similarly unexplored has been whether the relationship of PV system size to home sales prices is linear, and/or is affected by either the size of the home or the age of the PV system.

This research has used a dataset of approximately 72,000 California homes, approximately 2,000 of which had PV systems installed at the time of sale, and has estimated a variety of different hedonic and repeat sales models to directly address the questions outlined above. Moreover, an extensive set of robustness tests were incorporated into the analysis to test and bound the possible effects and increase the confidence of the findings by mitigating potential biases. The research was not intended to disentangle the various individual underlying influences that might dictate the level of the home sales price premium caused by PV, such as, energy costs savings, the net (i.e., after applicable state and federal incentives) installed cost of the PV system, the possible presence of a green cachet, or seller attributes. Instead, the goal was to establish credible estimates for the aggregate PV residential sale price effect across a range of different circumstances (e.g., new vs. existing homes, PV system age).

The research finds strong evidence that homes with PV systems in California have sold for a premium over comparable homes without PV systems. More specifically, estimates for average PV premiums range from approximately $3.9 to $6.4 per installed watt (DC) among a large number of different model specifications, with most models coalescing near $5.5/watt. That

value corresponds to a premium of approximately $17,000 for a relatively new 3,100 watt PV system (the average size of PV systems in the study). These results are similar to the average increase for PV homes found by Dastrop et al. (2010), which used similar methods but a different dataset, one that focused on homes in the San Diego metropolitan area. Moreover, these average sales price premiums appear to be comparable to the average *net* (i.e., after applicable state and federal incentives) installed cost of California residential PV systems from 2001-2009 (Barbose et al., 2010) of approximately $5/watt, and homeowners with PV also benefit from electricity cost savings after PV system installation and prior to home sale.

Although the results for the full dataset from the variety of models are quite similar, when the dataset is split among *new* and *existing* homes, PV system premiums are found to be markedly affected, with *new* homes demonstrating average premiums of $2.3-2.6/watt, while *existing* homes are found to have average premiums of $6-7.7/watt. Possible reasons for this disparity between *new* and *existing* PV homes include: differences in underlying net installation costs for PV systems; a willingness among builders of new homes to accept a lower PV premium because PV systems provide other benefits to the builders in the form of product differentiation, leading to increased sales velocity and decreased carrying costs; and, lower familiarity and/or interest in marketing PV systems separately from the other features of *new* homes contrasted with a likely strong familiarity with the PV systems among *existing* home sellers.

The research also investigated the impact of PV system age on the sales price premium for existing homes, finding - as would be expected - evidence that older PV systems are discounted in the marketplace as compared to newer PV systems. Finally, evidence of returns to scale for either larger PV systems or larger homes was investigated but not found.

In addition to benchmarking the results of this research to the limited previous literature investigating the sales price premiums associated with PV, our results can also be compared to previous literature investigating premiums associated with energy efficiency (EE) or, more generally, energy cost savings. A number of those studies have converted this relationship into a ratio representing the relative size of the home sales price premium to the annual savings expected due to energy bill reductions. These ratios have ranged from approximately 7:1

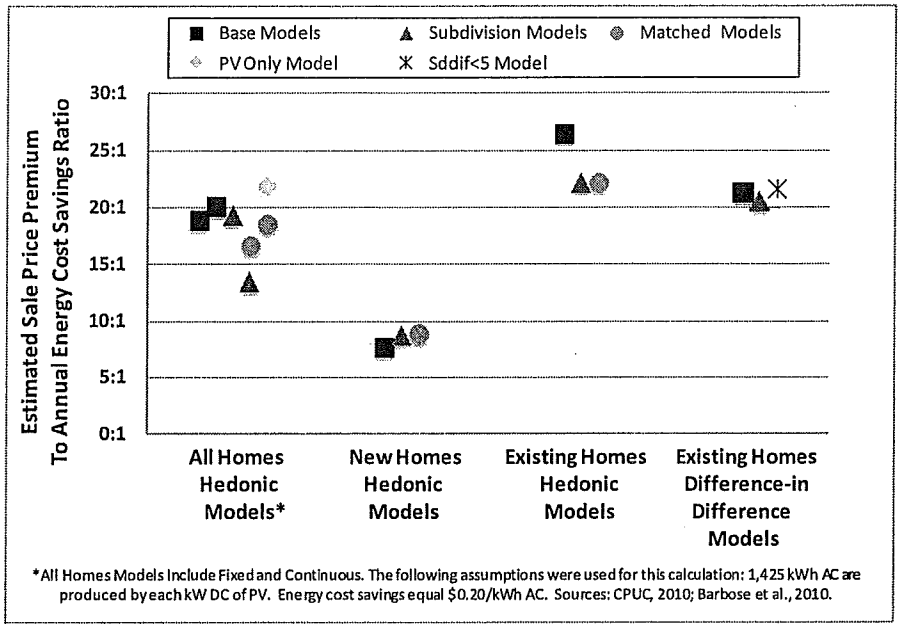
(Longstreth et al., 1984; Horowitz and Haeri, 1990), to 12:1 (Dinan and Miranowski, 1989), to approximately 20:1 (Johnson and Kaserman, 1983; Nevin et al., 1999; Eichholtz et al., 2009), and even as high as 31:1 (Nevin and Watson, 1998).

Although actual energy bill savings from PV for the sample of homes used for this research were not available, a rough estimate is possible, allowing for a comparison to the previous results for energy-related homes improvements and energy efficiency. Specifically, assuming that 1,425 kWh (AC) are produced per year per kW (DC) of installed PV on a home (Barbose et al., 2010; CPUC, 2010)[43] and that this production offsets marginal retail electricity rates that average $0.20/kWh (AC) (Darghouth et al., 2010), each watt (DC) of installed PV can be estimated to save $0.29 in annual energy costs. Using these assumptions, the $/watt PV premium estimates reported earlier can be converted to sale price to annual energy savings ratios (see Figure 5).

A $3.9 to $6.4/watt premium in selling price for an average California home with PV installed equates to a 14:1 to 22:1 sale price to energy savings ratio, respectively. For *new* homes, with a $2.3-2.6/watt sale price premium, this ratio is estimated to be 8:1 or 9:1, and for *existing* homes, with an overall sale price premium range of $6-7.6/watt, the ratio is estimated to range from 21:1 to 26:1. Without actual energy bill savings, these estimates are somewhat speculative, but nonetheless are broadly consistent with the previous research that has focused on EE-based home energy improvements.

[43] The 1,425 kWh (AC) estimate is based on a combination of a 19% capacity factor (based on AC kWh and CEC-AC kW) from CPUC (2010), and an 0.86 conversion factor between CEC-AC kW and DC kW (Barbose et al., 2010).

Figure 5: Estimated Ratios of Sale Price Premium to Annual Energy Cost Savings



Although this research finds strong evidence that homes with PV systems in California have sold for a premium over comparable homes without PV systems, the extrapolation of these results to different locations or market conditions (e.g., different retail rates or net installed costs) should be done with care.

Finally, additional questions remain that warrant further study. Perhaps most importantly, although the dataset used for this analysis consists of almost 2,000 PV homes, the study period was limited to sales occurring prior to mid-2009 and the dataset was limited to California. Future research would therefore ideally include more-recent sales from a broader geographic area to better understand any regional/national differences that may exist as well as any changes to PV premiums that occur over time as the market for PV homes and/or the net installed cost of PV changes. More research is also warranted on *new* versus *existing* homes to better understand the nature and underlying drivers for the differential premium discovered in this research; in addition to further hedonic analysis, that research could include interviewing/surveying home builders and buyers and exploring the impact of demographic, socio-economic, and others factors on the PV premium.

Additionally, future research might compare sales price premiums to actual annual home energy cost savings, to not only to explore the sale price to annual energy cost savings ratio directly, but also to explore if a green cachet exists over and above any sale price premiums that would be expected from energy cost savings alone. Further, house-by-house PV system and other information not included in the present study might be included in future studies, such as the actual net installed costs of PV for individual households, rack-mounted or roof-integrated distinctions as well as other elements of PV system design, the level of energy efficiency of the home, whether the home has a solar hot water heater, whether the PV system is customer or 3rd party owned at the time of sale, and if the homeowner can sell the green attributes the system generates.[44] Such research could elucidate important differences in PV premiums among households, PV system designs and state and federal programmatic designs, as well as bolster confidence in the magnitude of the PV premium estimated here. Finally, and more generally, additional research could investigate the impact of PV systems on the time homes remain on the market before sale, a factor that may be especially important for large developers and sellers of *new* homes.

[44] 3rd party owned PV systems would not be expected to command the same sort of premium as was discovered here. Although the level of penetration of 3rd party owners in our data was not significant (below 10%), and therefore would likely have not influenced our results in a substantive way, any future research, using more recent data, must account for their inclusion specifically.

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