Market-Based Investigation of Residential Solar Installation Values in Oregon

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Summary

This study uses the residential sales comparison appraisal method to isolate the market value of solar photovoltaic (PV) and solar hot water (thermal) systems. Sales comparison is the most common valuation methodology in practice for residential real estate. Using the sales comparison method, the contributory value of solar installations on sold residential properties can be isolated, with this isolated contributory value reflecting its actual market value. This approach to valuing a solar installation is unique from other methods of determining the value of solar amenities, such as net present value of future energy savings, as it focuses on the actual price paid in the market for the solar systems by people who did not originally have the systems installed. This preliminary study provides these initial findings.

Initial Key Findings

- From the 23 properties analyzed in this study, an average contributory value opinion was found of $9,861 - $12,817.
- The values in this report appear to rise over time, from lower apparent market values for the installations in 2005 to higher values in 2010.
- There is no negative contributory value association with the solar installations.

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Background

For a considerable time, the appraisal and solar communities have pondered the question of the market value of solar thermal and solar PV systems. In many areas, solar installations are supported by governmental and/or local utilities that subsidize the installations in some way, usually through a combination of rebates on the purchase price of the installation and/or tax credits.

With the rise in energy costs over the past several years and a clearer understanding of the issue of climate change on an international level, citizens, utilities, and governments have increased efforts to harness solar power and conserve energy. This has led to an increase in residential solar installations and a commensurate amount of spending on solar. However, while the number of installations has grown greatly, the total amount of installations relative to the number of residential properties is still quite low. Understanding the value of solar on homes could increase solar adoption. If a solar installation increases the value of a home, this could be influential in some homeowners' decision to install solar.

A review of studies concerned with the value of residential energy savings, whether by solar or by other means, demonstrates the lack of information on residential solar values. Of several extant studies, those most commonly cited for the residential market value of energy savings were completed by Rick Nevin et.al[1]. These studies are over a decade old, and they approach the value of energy efficiency through window replacement. A study of the

[1] Nevin, Rick, et.al., "Evidence of Rational Market Valuations for Home Energy Efficiency," *Appraisal Journal* (August 1998) and Nevin, Rick, et.al., "More Evidence or Rational Market Values for Home Energy Efficiency," *Appraisal Journal* (October 1999).

In addition to those above, the following studies relate to energy efficiency and residential market value:

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

Dinan, Terry, Miranowski, John, "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.

Quickley, J., Eichholtz. P., and Kok, N., "Doing Well by Doing Good? Green Office Buildings," (working paper at European Centre for Corporate Engagement 2009).

ENERGY STAR® building program in the Northwest states provides some qualitative information on residential energy efficient homes[2], but none of these studies directly addresses the actual market value of solar photovoltaic or solar water heating systems.

Two more recent studies attempt to arrive at a reasonable opinion of market value for residential solar PV systems in the state of California, and each arrives at similar conclusions through differing methodologies. Dastrop, Zivin, Costa, and Khan's study in San Diego showed 3%-6% price premiums paid on properties with solar systems, while Hoen, et al. found average contributory values of approximately $17,000 for a relatively new 3,100 watt PV system. While large amounts of data have been analyzed in these studies and multiple regression analyses have been conducted on the data to arrive at conclusions, none of the studies employs the valuation techniques most often used in the residential real estate market to determine market value.

The question thus remains: what does it appear that actors in the market (outside the original purchaser of the system) actually paid for these systems? The answer to that question would provide a clearer sense of market value, as separate from the cost of the systems. This study attempts to answer these questions in a novel way—by applying established appraisal methods and actual valuations to homes with solar installations.

Methods

Because many appraisers work within a particular definition of market value, the application of appraisal principles to ascertain whether there is market value in solar installations appeared to be a worthwhile avenue to pursue. This led the following question: *would it be possible to isolate the contributory value, if any, of a residential solar installation using the sales comparison approach to value?*

In residential real estate appraisal, the sales comparison approach to value is generally considered to be the most reliable means of arriving at an opinion of market value and is the most commonly applied and most widely understood method. This approach applies the principle of ***contribution***, which is "the concept that the value of a particular component is measured in terms of the amount it adds to the value of the whole property or as the amount that its absence would detract from the value of the whole. "[3] This amount, its "contributory value," depends on market forces and is independent of the item's cost.

From this question, it was posited that a sales comparison analysis to isolate the contributory value of a solar installation could be carried out if several conditions were met: 1) if the value of a property with solar was known as of a certain date, 2) if the identified property

[2] ECONorthwest, ENERGY STAR Homes Northwest Program Quarterly Report (2010).

[3] Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 5th ed. (Chicago: Appraisal Institute, 2010).

generally conformed to other residential properties in its area, and 3) if there were sufficient comparable data available with which to complete a reliable valuation in the sales comparison approach.

In order to establish whether these conditions were present, data for properties with solar installations would need to be gathered and analyzed, and for that reason, Energy Trust of Oregon was approached with a plan for isolating the contributory value, if any, of solar installations. Energy Trust is an independent nonprofit organization helping Oregonians invest in energy efficiency and renewable resources.[4] As such, Energy Trust manages rebates for the majority of residential solar installations in Oregon, and therefore has information on most of the solar installations in the state placed into service over the past decade.

Approach

Through conversations with valuation professionals and Energy Trust, the following approach to ascertain the contributory value of solar installations, if any, was developed:

Step 1. Energy Trust records would be searched for transfers since the installation of a solar system, which would help identify the market value of a property as of a certain date.

Step 2. Those properties that had transferred would be vetted by appraisers to determine if the identified property generally conformed to other properties in its area and if there were sufficient comparable data available with which to complete a reliable valuation in the sales comparison approach.

Step 3. Properties identified in Step 2 would be appraised retrospectively under the hypothetical condition that there was no solar installation on the property at the time of its sale.

Step 4. A minimum of one review by a real property appraiser would be performed on each retrospective appraisal report to address its reliability and provide an additional opinion of value if necessary.

Step 5. An analysis of the valuation results would be conducted in order to determine the contributory value, if any, of the solar installations in different market areas in Oregon.

[4] To learn more about Energy Trust of Oregon, please visit www.energytrust.org.

Approach - Steps 1 and 2

Property Identification and Preliminary Analysis

This approach was carried out in two phases, the first of which occurred in 2008 and analyzed properties that transferred between 2003 and 2008 in the Portland and Bend markets. The second phase of the study was carried out in 2011 and analyzed properties that transferred between 2008 and 2011 in the same areas as well as several other parts of the state, including Hillsboro, Tigard, Corvallis, and Ashland. This phased approach allows the collection of more data as well as the analysis of buyer trends over an eight-year period.

Phase 1

Energy Trust reviewed the list of the hundreds of installations it had completed on properties in the Portland and Bend areas between late 2003 and late 2008 and identified those that had transferred ownership during that same time period. The relatively small number of transferred properties (17) then went through a preliminary analysis to determine whether each transfer was arms-length[5], whether each generally conformed to other residential properties in its area, and whether sufficient comparable data were available for each transferred property.

The preliminary analysis consisted of researching the sales history of the properties from two sources, checking the characteristics of each property from two sources, searching for comparable sales within six months previous to the transfer date of the subject property, and viewing the each property's exterior from a public street. There were 10 properties in Phase 1.

Phase 2

In Phase 2, additional installations in the Portland and Bend areas were checked against transfers between 2008 and 2011 as well as installations in other portions of the state, including Hillsboro, Tigard, Corvallis, and Ashland. There were 13 properties in Phase 2.

Table 1 lists all of the transferred properties with solar installations from Phases 1 and 2 that were judged to be acceptable candidates for the study based on property characteristics and the amount of comparable data available with the type of solar measures installed on each.

[5] An arms-length transaction is a "transaction between unrelated parties who are each acting in his or her own best interest." Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 5th ed. (Chicago: Appraisal Institute, 2010). An arms-length transaction is one of the necessary components in determining market value.

Table 1. Property and Type of Solar Installation in Phases 1 and 2

Property	*Type of installation*	*Property*	*Type of installation*
West Linn 1	Solar thermal	Bend 5	Solar PV
Portland 1	Solar PV & thermal	Bend 6	Solar PV
Portland 2	Solar PV & thermal	Bend 7	Solar PV
Portland 3	Solar PV	Bend 8	Solar PV
Portland 4	Solar PV & thermal	Corvallis 1	Solar PV
Portland 5	Solar PV & thermal	Corvallis 2	Solar PV
Beaverton 1	Solar PV	Corvallis 3	Solar PV & thermal
Tigard 1	Solar PV	Hillsboro 1	Solar PV
Bend 1	Solar PV	Hillsboro 2	Solar PV
Bend 2	Solar PV & thermal	Ashland 1	Solar PV
Bend 3	Solar PV & thermal	Ashland 2	Solar PV
Bend 4	Solar PV		

Approach - Steps 3 and 4

Appraisal and Review Process

To apply the sales comparison approach to value, an exterior-only (Fannie Mae form 2055), retrospective appraisal report was completed for each of the properties in the study. In the case of the study properties, each retrospective date was the property's previous date of arms-length, open-market transaction (or sale). After conducting the preliminary analysis described above, this process includes viewing the subject property from a public street, viewing all of the comparables from a public street, and then conducting the valuation analysis on each property.

After an appraisal was completed on each property by a certified appraiser actively working in and familiar with that market area, each of the completed reports was, at a minimum, desk reviewed by at least one appraiser. Desk reviews are reviews of other appraisers' work commonly conducted in the appraisal industry as a means of verifying the credibility of the appraisal report under review but that do not include an inspection of the subject property. The scope of work for the review portion of the study focused on: the appropriateness of the comparable data considered, the adjustments made, and the conclusions reached. If the appraiser completing the desk review believed that there was reason enough to investigate the valuation further, a full field review was conducted. A field review includes a viewing of the subject property as well as all of the comparables in the report under review and may include a valuation of the subject property by the reviewer. Thus, in the case of a field review, the reviewer arrives at a second opinion of value for the property. For the properties

that had field reviews conducted, this paper lists both opinions of value: those of the original appraiser, and those of the field reviewer.

Appraisal Review - Portland Area

Phase 1 – The first local reviewer believed that two of the value conclusions reached were supported by the data, and that one was supported at a different value, which reflected a disagreement in value of $4,500, or 1.63 percent, of the value opinion of the original appraisal. This difference is reflected in Table 3. The second reviewer believed that all of the value conclusions reached were reasonable and supported.

Phase 2 – The local review resulted in agreement with the original appraiser's opinion of value on all of the properties.

Appraisal Review - Bend Area

Phase 1 – The review appraiser in the Bend area agreed with the valuation of one of the six properties and disagreed with the valuations of five of the properties. On two of these five properties, the reviewer and appraiser's opinions disagreed by 0.60 percent and 1.50 percent. For the other three properties, the reviewer's opinion matched the original sales price of the properties. Thus, for three of the six Bend properties in Phase 1, the reviewer's opinion was that there was no contributory value for the solar element. The primary reasons for the disagreement were with some of the adjustments to value made in the original appraisals and some of the comparable sales analyzed by the primary appraiser. Because of the disagreement with the Bend appraisals, it was decided that there should be further in-depth analysis completed on those properties.

To that end, full field reviews were performed by the review appraiser on the Bend study properties, providing additional opinions of value for these properties. This lead to further support for positive market reactions to solar in the study. The Bend properties, their sales prices, and the appraiser and reviewer's opinions of value are shown in Table 2.

Table 2. Bend Properties' Sold Prices and Opinions of Value without Solar

Property	*Sold Price $*	*Sold Date*	*Appraiser's Opinion $*	*Reviewer's Opinion $*	*A-R Difference $ - %*
Bend 1	335,900	2/24/2006	320,000	322,000	2,000 - 0.60%
Bend 2	675,000	7/10/2007	655,000	655,000	0 - 0%
Bend 3	409,000	4/24/2007	393,000	399,000	6,000 - 1.47%
Bend 4	329,000	12/13/2005	316,000	329,000	13,000 - 3.95%
Bend 5	336,000	10/6/2005	320,000	336,000	16,000 - 4.76%
Bend 6	590,000	7/16/2006	567,000	590,000	23,000 - 3.90%

For the Bend properties, the appraiser's and reviewer's opinions differed more than 1.47 percent for three properties, and for those three, the overall value opinion difference was 3.90 - 4.76 percent. While in the larger valuation picture these latter three differences of opinion are not large, when attempting to isolate the contributory value of an element of a property, they are significant and should be noted. In simple terms, the original appraiser believed that there was contributory value in each of the six cases, while the review appraiser believed that there was contributory value in only three of the six cases. Due to these differences, all opinions of value, whether from appraiser or reviewer, are presented in this analysis. In five out of the six cases above, the more recent the sale, the greater the agreement between contributory values from the two appraisers. This occurrence of notable contributory value over time will be revisited later in this study.

Phase 2 – There were no field reviews necessary for any of the Bend properties identified in the second phase of the study. All conclusions reached by the appraisers were supported in the primary review process.

Appraisal Review - Hillsboro, Tigard, Corvallis, and Ashland

Phase 2 - There were no field reviews necessary for any of the properties in these areas identified in the second phase of the study. All conclusions reached by the appraisers were supported in the primary review process.

Approach - Step 5

Analysis

For the properties included in this study, the retrospective appraised value conclusions differed from the transfer prices of the properties by varying degrees, as Table 3 indicates.

The sales comparison approach found that there is some value contribution apparent in most of the solar installations in the study. Contribution ranged from zero to $31,000, with an average contributory value of $9,861 - $12,817. The range of average value is based on the differing opinions of value between appraisers and reviewers on certain properties and will be expanded upon in the study.

Table 3. Study Properties and Value Opinions

The table displays the range of contributory value opinions from the appraisers and reviewers of each property.

Property	*Sold Price $*	*Appraised Opinion $*	*Difference +/- $*	*Date of Transfer*
Ashland 1	238,500	236,000	2,500	2/7/2008
Ashland 2	555,000	550,000	5,000	7/21/2009
Beaverton 1	292,500	288,000 - 292,500	0-4,500	1/14/2005
Bend 1	335,900	320,000 - 322,000	13,900-15,900	2/24/2006
Bend 2	675,000	655,000 - 655,000	20,000	7/10/2007
Bend 3	409,000	393,000 - 399,000	10,000-16,000	4/24/2007
Bend 4	329,000	316,000 - 329,000	0-13,000	12/13/2005
Bend 5	336,000	320,000 - 336,000	0-16,000	10/6/2005
Bend 6	590,000	567,000 - 590,000	0-23,000	7/6/2006
Bend 7	339,000	330,000	9,000	11/5/2009
Bend 8	254,000	235,000	19,000	4/15/2010
Corvallis 1	265,000	252,000	13,000	2/11/2010
Corvallis 2	250,000	250,000	0	5/28/2008
Corvallis 3	415,000	400,000	15,000	6/27/2008
Hillsboro 1	165,000	163,500	1,500	4/14/2010
Hillsboro 2	195,000	186,000	9,000	10/15/2010
Portland 1	470,000	458,000	12,000	8/9/2007
Portland 2	399,000	393,000	6,000	8/11/2006
Portland 3	395,000	384,500	10,500	3/26/2009
Portland 4	465,000	438,500	26,500	5/17/2010
Portland 5	335,000	304,000	31,000	6/17/2010
Tigard 1	315,000	296,000	19,000	6/19/2009
West Linn 1	399,900	392,500 - 396,000	3,900-7,400	1/22/2008
Average			**9,861 - 12,817**	

The value differences between the appraised amounts and the transfer amounts are also expressed in terms of percentage of overall value at time of transfer in Table 4.

The range in the percentage of contributory value opinions ranges from 2.80 percent when considering the lowest opinions to 3.54 percent when considering the highest opinions.

Table 4. Properties' Average Difference in Value as Percentage

Property	*Difference +/- $*	*% Value*
Ashland 1	2,500	1.05
Ashland 2	5,000	0.90
Beaverton 1	0 - 4,500	0-1.54
Bend 1	13,900 - 15,900	4.14-4.73
Bend 2	20,000	2.96
Bend 3	10,000 - 16,000	2.44-3.91
Bend 4	0 - 13,000	0-3.95
Bend 5	0 - 16,000	0-4.76
Bend 6	0 - 23,000	0-3.90
Bend 7	9,000	2.65
Bend 8	19,000	7.48
Corvallis 1	13,000	4.91
Corvallis 2	0	0
Corvallis 3	15,000	3.61
Hillsboro 1	1,500	0.91
Hillsboro 2	9,000	4.62
Portland 1	12,000	2.55
Portland 2	6,000	1.50
Portland 3	10,500	2.66
Portland 4	26,500	5.70
Portland 5	31,000	9.25
Tigard 1	19,000	6.03
West Linn 1	3,900 - 7,400	0.98-1.85
Average		**2.80 – 3.54**

Differences of Opinion of Contributory Value

There are five properties out of the 23 studied that show a contributory value of zero: Beaverton 1, Bend 4, Bend 5, Bend 6 and Corvallis 2. Four of these properties included two opinions of value, one from the original appraiser, and one from a reviewer. In the Beaverton and Bend properties, the reviewer and appraisers' opinions were different, resulting in a range from zero to the higher opinion of contributory value for each property. In the case of Corvallis 2, there was agreement between appraiser and reviewer of no contributory value for solar.

Three other properties also show differences of opinion between appraiser and reviewer: West Linn 1, Bend 1 and Bend 3, with differences of opinion ranging from $2,000 to $6,000. Because these differences are all valid opinions of market value, they are all included in the table. When averaged with all of the properties in the study, the grouping of

all properties with the lower opinions with the remainder of the properties yields an average contributory value of $9,861, while grouping and then averaging all of the higher opinions from these properties shows a contributory value of $12,817. Thus, the range of contributory value in this study is from $9,861 - $12,817 when including all opinions of value.

Discussion

An appraisal is an opinion of market value. Because of this, it can be difficult to ascertain its margin of error, especially when considering that each report is different, reflecting the unique nature of the subject properties. Appraisers understand and acknowledge this. In informal surveying of over three hundred residential appraisers in different areas of the US, appraisers were asked by the author to consider what they believed to be their average margin of error on appraisal assignments conducted over the course of the previous year as a whole. When given ranges of 0-5 percent, 5-10 percent, or 10 percent and above, the majority of appraisers consistently stated that they believed their average margin of error was 5-10 percent, with approximately 2.5 percent above and below the final appraised value for the property being a reasonable margin[6]. Though anecdotal, this illustrates the reality that opinions of value developed through the appraisal process are slightly variable. This is understood by the appraisal community and reflected in the opinions of value in this study.

While the opinions of contributory value for solar installations in this study may fall within a typical residential appraisal's margin of error, there is a consistent, though slight, value difference between the appraised values and the sold prices of the properties. As shown in Table 3, of the 31 total opinions of value, only five are opinions of no contributory value, and there are no opinions of negative value. This consistency in opinions within the slightly variable nature of appraisal practice strongly indicates that there is contributory value in these solar installations and that they have no negative influence on value.

Contribution and Time of Sale

The transfer date range of all of the properties analyzed is from 1/14/2005 to 10/15/2010. As Table 5 shows, there is a general trend upward over time from the lower opinions of value to the higher opinions. Further, all of the opinions of no discernable contributory value are found in the first half of the time period analyzed.

[6] Residential appraisers in the Portland area were questioned on their estimated margin of error on 9/2009 and 5/2010. Residential appraisers in the Bend area were questioned on their estimated margin of error on 4/2010. Appraisers in the Seattle, Washington and Huntsville, Alabama areas were questioned in 10/2011, and appraisers in the Richmond, Virginia area were questioned in 12/2011. Appraisers in Montgomery, Mobile, Dothan, Tuscaloosa, Auburn, and Birmingham, Alabama and Charlottesville and Roanoke, Virginia were questioned in 2012.

Table 5. Opinion of Value and Date of Sale

Property	*Date of Transfer*	*Contributory value $*
Beaverton 1	1/14/2005	0 - 4,500
Bend 5	10/6/2005	0 - 16,000
Bend 4	12/13/2005	0 - 13,000
Bend 1	2/24/2006	13,900 - 15,900
Bend 6	7/6/2006	0 - 23,000
Portland 2	8/11/2006	6,000
Bend 3	4/24/2007	10,000 - 16,000
Bend 2	7/10/2007	20,000
Portland 1	8/9/2007	12,000
West Linn 1	1/22/2008	3,900 - 7,400
Ashland 1	2/7/2008	2,500
Corvallis 2	5/28/2008	0
Corvallis 3	6/27/2008	15,000
Portland 3	3/26/2009	10,500
Tigard 1	6/19/2009	19,000
Ashland 2	7/21/2009	5,000
Bend 7	11/5/2009	9,000
Corvallis 1	2/11/2010	13,000
Hillsboro 1	4/14/2010	1,500
Bend 8	4/15/2010	19,000
Portland 4	5/17/2010	26,500
Portland 5	6/17/2010	31,000
Hillsboro 2	10/15/2010	9,000

This trend of increasing opinions of value over time may be attributable to several causes. It is possible that the size of the property sample lends itself to this trend. It could also be attributable to the development of the solar market, a rise in overall fuel costs, or an increase in positive public perception in these markets of the value of solar over time. If this trend continues to develop and is evidenced in more properties added to the study, it may comment favorably on the market acceptance and value of solar installations moving forward.

Cost Versus Market Value

In general, most new solar installations receive some kind of financial incentive for the buyer. These incentives can be in the form of rebates or tax credits on the purchase price of the system. Table 6 shows the rebates and/or tax credits that the solar systems in the study

qualified for at the time of installation.[7] The table also displays the total cost for the installation and the estimated total out-of-pocket expense for the customer after all rebates and tax credits.

Table 6. Solar Installation Costs

Property	*Type*	*Project Cost*	*Energy Trust Incentive*	*Tax credits (present value)*	*Out-of-Pocket Cost*
Ashland 1	PV	$26,000	$12,750	$1,389	$11,861
Ashland 2	PV	$13,978	$5,400	$1,389	$7,189
Beaverton 1	PV	$26,000	$12,750	$1,389	$11,861
Bend 1	PV	$16,150	$12,480	$1,389	$2,281
Bend 2	PV & Thermal	$21,690	$7,560	$4,630	$9,500
Bend 3	PV & Thermal	$25,805	$13,760	$2,778	$9,267
Bend 4	PV	$15,650	$6,660	$1,389	$7,601
Bend 5	PV	$16,100	$11,232	$1,389	$3,479
Bend 6	PV	$17,280	$12,480	$1,389	$3,411
Bend 7	PV	$17,760	$5,760	$6,820	$5,180
Bend 8	PV	$17,477	$12,480	$1,389	$3,608
Corvallis 1	PV	$18,700	$4,340	$6,820	$7,540
Corvallis 2	PV	$7,050	$1,550	$3,624	$1,876
Corvallis 3	PV & Thermal	$23,674	$5,480	$9,564	$8,630
Hillsboro 1	PV	$17,700	$12,750	$1,389	$3,561
Hillsboro 2	PV	$12,509	$3,623	$7,436	$1,450
Portland 1	PV & Thermal	$27,300	$10,540	$4,463	$12,297
Portland 2	PV & Thermal	$13,610	$4,547	$2,019	$7,044
Portland 3	PV	$19,414	$7,735	$4,968	$6,711
Portland 4	PV & Thermal	$33,838	$5,940	$9,505	$18,393
Portland 5	PV & Thermal	$42,566	$7,560	$16,081	$18,925
Tigard 1	PV	$8,544	$2,756	$3,747	$2,041
West Linn 1	Thermal	$6,500	$660	$2,619	$3,221
			Average Out-of-Pocket Cost		**$7,258**

The incentives and tax credits available to these projects varied, depending on the year of the installation and state and federal tax policy at the time. Tax credits are then taken by the owners when they file their returns for the tax year of the installation. For PV systems

[7] Information in this table provided by Energy Trust of Oregon. Tax credits are estimated based on the incentives available for solar projects at the time of installation and shown. Tax credit values are shown as present value because they are claimed in the tax year following the installation and, in the case of some state credits, for up to four years following the installation. A discount rate of eight percent was used. In some cases, the homeowner may have been unable to claim all tax credits. This would result in a higher out-of-pocket cost than is estimated here. It is also possible that a typical homeowner would not discount the tax credits in this manner but rather consider them as a lump-sum benefit. If this was the case, then the discounted tax credits applied here would understate the tax benefit and overstate the out-of-pocket cost.

installed after 2005, the state tax credit, which was worth up to $6,000 depending on the project size, would have taken four years to claim. The Energy Trust incentive passes through directly to the solar installer, leaving the owner with less initial out-of-pocket cost.

In acknowledgement of the discounted value of future income (the tax credits that homeowners would claim in future years), the tax credits shown in Table 6 are represented as present values, while the Energy Trust incentives shown in Table 6 reflect the actual incentive amounts received by the properties at the time of installation.

The out-of-pocket costs for the solar installations after the Energy Trust incentive and present value of the tax credits ranged from $1,450 to $18,925, with an average of $7,258. This average can then be compared to an estimated $9,861 to $12,817 of contributory market value. In these cases, the average out-of-pocket cost is lower than the range of average contributory values of the solar installations.

Conclusions and Recommendations

From the 23 properties analyzed in this study, 22 of which had PV, one of which had solar thermal, and seven that have both systems, an average contributory value opinion of $9,861 to $12,817 was found. This range of opinion of value was determined by using traditional residential real estate appraisal methods that employ market data from sold properties, and each opinion of value was reviewed by at least one other real estate appraisal professional.

The opinions of value also appear to rise over time, from lower and more variable opinions of value in 2005 to higher and more consistent values in 2010. It is likely that this trend is attributable to an increased public awareness of renewable energy systems and of rising fuel costs in Oregon. There also appears to be a close relationship between the contributory market value of the solar installations and their average out-of-pocket costs after incentives and tax credits.

There are a limited number of properties in this study. This is due to the relatively small number of transfers over time of properties with solar installations. This may suggest that owners that make the investment in solar upgrades wish to see the benefit of these upgrades over time and therefore remain in their properties longer. Or, it may suggest that the residential solar owner is part of a distinct market segment from the typical residential property owner.

Though the study sample is small, the trend of contributory value appears to be strong. Further additions to this study over time may clarify these preliminary results and lead to a deeper understanding of the contributory of residential solar installations.