



Unveiling High-Performance Home Premiums in Washington, D.C.

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September 2015



What is Green Worth?

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Executive Summary

The rise of high-performance homes (HPHs) is a growing trend across the county that cannot be ignored. This study examines the question of how the addition of green features affects a home's value and sales price. Are buyers willing to pay a premium for green features?

This paired sales analysis of HPHs in Washington, D.C., clearly supports a premium for residential green features, while also highlighting challenges in identifying the value of green features, which may be preventing homeowners from receiving sales premiums for their HPHs.

The data for this study included 40 total sales in the District between February 2013 and June 2015: eight HPH sales and 32 non-HPH sales. The sales represented seven different areas within the Washington, D.C. market, as indicated in Table 1.

Table 1: Home Sales in the District of Columbia Analyzed for This Study

ZIP Code	No. of Sales Per ZIP Code
20001	7
20004	2
20005	3
20009	5
20010	4
20011	13
20012	6
Total Sales	40

The number of HPHs used in this study was small because multiple listing service (MLS) data currently does not reflect the true number of HPHs in the District. Previous research in the District found that, between 2008 and 2013, only 27 unique, certified HPH units, or 14.8 percent of the expected certified HPHs, were listed in the MLS using third-party verified green fields.

In this study, the eight HPH sales were each paired with three or more non-HPH sales, creating a credible dataset of 32 paired sales. The primary outcomes of the study are as follows:

- Thirty-two paired sales are the basis for the opinions in this study, with 29 pairs supporting the existence of green premiums and only three providing inconclusive results.
- Nineteen of the 32 paired sales had premiums between 2–5 percent.

- The mean green premium is 3.46 percent, while the median green premium is 2.91 percent.
- Six of the eight HPHs used in this study had third-party certifications from LEED, the green building certification system from the U.S. Green Building Council, and the two non-certified HPHs were still found to have green premiums.
- Three of the eight HPHs benefited from solar photovoltaic (PV) systems. However, one of the systems was a common area amenity and not owned by the individual unit.
- The MLS listings contained scant description of the green features associated with the eight HPH sales. However, the term “LEED” was used in each listing, even for the two HPH sales that were not LEED certified.
- None of the HPH sales had energy or green reports attached to their MLS listing, and none reported actual or estimated energy costs.

While this study’s conclusions clearly demonstrate that residential green features are valued in the market and result in significant sales premiums for HPHs, the challenging process to arrive at these conclusions exposes the need for improved HPH data collection and reporting in the District. In addition, to achieve more accurate HPH transactions, the market needs real estate professionals with knowledge of green building principles and practices. Otherwise, homeowners may miss out on significant value green features can add to their transactions.

1. Background

Incorporating green features into homes in Washington, D.C., is a growing trend that cannot be ignored. As of September 2, 2015, the District had 457 LEED-certified homes,¹ and as of August 2015, 329 new ENERGY STAR® Homes had been certified. To date, while no homes or multifamily buildings in the District have been certified through the ICC 700 National Green Building Standard (NGBS), several multifamily buildings are in the process of obtaining this certification.

The April 2015 study *Greening the MLS: Bringing High-Performance Homes to Light in the District of Columbia*² quantified HPHs as a percentage of total residential sales in the District in 2013. The study found widespread demand for HPHs, with HPH sales accounting for 18 percent of the total residential sales. Some areas demonstrated above-average market penetration of HPH sales, such as the Friendship/Chevy Chase area (ZIP code 20015), which showed a maximum of 29.1 percent of its sales in the high-performance category. This previous study defined a HPH as a home that used at least one of the more than 35 green fields offered by Metropolitan Regional Information System (MRIS), the local MLS.

The following table provides recent search results from MRIS for listings specified as green buildings under ENERGY STAR or LEED. In addition to the properties noted in the table, many more listings and sold properties have one or more green features mentioned. The data indicate that green features and HPHs remain an active part of the District's residential market.

¹ <http://www.usgbc.org/projects/homes>.

² IMT, Elevate Energy, MRIS, and DC's Department of Energy and Environment, *Greening the MLS: Bringing High-Performance Homes to Light in the District of Columbia*, (Washington, D.C., 2015).

Table 2: MRIS Search Results as of Sept. 2, 2015 for Washington, D.C.

Search Criteria: Residential Properties Only	Number of Properties Identified
Number of current active and under contract listings with ENERGY STAR® in the pick list field	37
Number of sold properties in D.C. with the word “energy” in a pick list field between January 1, 2013, and August 31, 2015	214
Number of current active and under contract listings with the word LEED® in the remarks section of the MLS listing	2
Number of sold properties in D.C. with the word LEED in the remarks section between January 1, 2013, and August 31, 2015	31
Number of current active and under contract listings with the words ENERGY STAR windows or door	32
Number of sold listings with the words ENERGY STAR windows or doors between January 1, 2013, and August 31, 2015	6

This increase in the number of units implementing green features is frequently raising questions such as:

- How much are green features worth?
- Do HPHs experience less time on the market than non-HPHs?

The April 2015 study indicated preliminary support for green premiums, but noted that more rigorous valuation analysis should be done to substantiate this finding. This report provides the needed robust analysis of the data, but major obstacles exist that made it difficult to detect and ascertain the value of green premiums.

1.1 MLS Data Limitations

The lack of consistent and complete MLS data for green features is a primary obstacle in determining these features' value. The limited number of HPH sales that can be identified in the MLS, coupled with a lack of documentation about these homes, is a challenge for appraisers when quantifying the market value of green features and may result in inaccurate appraised values.

MLS data does not accurately reflect the true number of certified HPHs in the local market. Specifically, data from third-party programs in the District indicated a total of 625 certified HPHs available for sale since 2000, or an expected 182 certified HPHs in the 2008–2013 study period. The MRIS data revealed, however, that only 27 unique units, or 14.8 percent of the expected certified HPHs, were listed in the MLS using third-party verified green fields from 2008–2013. The study also cited an informal estimate from CoreLogic, an MLS software and database provider, that when green

fields are available in a given market, only 3–5 percent of the listings actually use these fields.

When the MLS includes green features in the search fields, the data available is often incomplete or absent. For example, in the table above of identified HPHs that are under contract or closed sales, none had attachments showing the green certification and score sheet, or an energy report. Attaching these reports provides buyers with what one calls “hidden value,” and allows appraisers to make better comparable and adjustment decisions.

Individual lender underwriting guidelines emphasize the need for complete data about each sale so that both buyers and appraisers can render appropriate value conclusions. Upon the sale or appraisal of a residential unit with green features, often no value is attributed to the green features, which may not even be identified in the MLS or appraisal process. In some areas, the lack of comparable sales with green features results in a misconception, often from a bank underwriter, that green features have no value.

Underwriters’ preferred appraisal method to support the value of green features is the “paired sales analysis”.³ Pairing sales is difficult because it is rare to find two properties that are identical except for the fact that one has green features. It is difficult to pair sales in an imperfect market characterized by incomplete reporting of property conditions, various seller and buyer motivations, extreme differences in building views, and sales prices that may not truly reflect the definition of market value.⁴

³ See section 2.2 Paired Sales Analysis.

⁴ *The Dictionary of Real Estate Appraisal, 5th Ed., Appraisal Institute.* The most widely accepted components of market value are incorporated in the following definition: “The most probable price that the specified property interest should sell for in a competitive market after a reasonable exposure time, as of a specified date, in case, or in terms equivalent to cash, under all conditions requisite to a fair sale, with the buyer and seller each acting prudently, knowledgeably, for self-interest, and assuming that neither is under duress.”

1.2 What makes a building green?

Beyond the limited MLS data, the lack of one standard definition for green building contributes to the problem of accurately valuing green features. The definition provided in this report is one that is widely used. It cites six elements of green building that are typically found in most third-party certifying organizations' green score sheets. A true green building will have characteristics of all six elements and should perform better than a building constructed to code. Of the six elements of green building, the energy and water elements are quantifiable. Their benefits can be described in dollars, which enhances marketing and provides data to quantify premiums in the appraisal process. This is not to say the other four elements have no value, but it is more difficult to identify their market impact as they cannot be quantified.

DEFINING GREEN BUILDING

Green Building: Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation, and deconstruction. This practice expands and complements the classic building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high-performance building.

Six Elements of Green Building:

1. Site
2. Water
3. Energy
4. Indoor Air Quality
5. Materials
6. Operations and Maintenance

Source: U. S. Environmental Protection Agency,
<http://archive.epa.gov/greenbuilding/web/html/about.html>

The paired HPH sales used in this report did not have energy reports or utility expenses listed in the MLS. The listings used the term "LEED" and assumed buyers have full knowledge of the benefits of

the certification. Buyers would have a better understanding of the benefits if, for example, energy costs were also reported. Full details of these quantifiable elements are also essential to developing the income approach for an appraisal.⁵

Understanding green building allows for more accurate HPH transactions. The market needs real estate professionals with knowledge of green building elements and sustainable practices to successfully market, manage, and appraise green buildings. Poorly marketed green properties often result in inaccurate appraised values. If a real estate agent can market the energy and water efficiency of a unit in a way that demonstrates value to a potential buyer, the buyer will be more likely to pay a premium for that unit.

2. Methodology

Over the past 10 years, green features have become a growing trend in the market, yet few studies of green features exist. Real estate appraisers author even fewer studies using standard appraisal methods. The most recent national, appraiser-driven study was *An Early Look at Energy Efficiency and Contributory Value: Case Studies of Residential Properties in the Greater Denver Metro Area* by Lisa K. Desmarais, SRA (Denver, CO; 2015), and focuses on energy efficiency. This appraiser-led report is the first of its kind in Washington, D.C.

Appraisers and their lending clients prefer studies that use paired sales analysis in a specific market area. While this method usually has limited data from which to draw conclusions, the paired sales results directly reveal the market's reaction to a given property feature. Appraisers and their lender clients are reluctant to use academic studies based on hedonic modeling and robust datasets because they often do not understand the methodology. The Uniform Standards of Professional Appraisal Practice (USPAP) requires appraisers to understand the work of others and deem it credible prior to relying on it in an appraisal.⁶

This section describes each of the appraisal methodologies that can be used, including the sales comparison approach (paired sales analysis), cost approach, and income approach. If all three approaches are used, they provide a means to measure *reasonableness*, ensuring a more credible value opinion. USPAP requires appraisers to use all applicable methods.

⁵ See section 2.4 Income Approach.

⁶ Uniform Standards of Professional Appraisal Practice, 2014-2015, Standard Rule 2-3, lines 854-858.

2.1 Test of Reasonableness

Pairing sales requires the use of imperfect market data and a degree of subjective judgment; therefore, employing more than one appraisal method, when the data permits, can verify the reasonableness of a valuation. For this study, it was not possible to obtain sufficient data on each HPH sale to use all three valuation approaches described below. However, the incremental cost of installing green features over the typical cost of building a home to code is a good metric to assess the overall reasonableness of the paired sales valuation. It is reasonable to assume that the market would not be willing to pay more for a product than what it would cost new.

2.2 Paired Sales Analysis

Paired sales analysis is a comparison of the sales price of a property that includes the study feature being analyzed (e.g. green features) with the sales price of a recently sold similar property that does not have the study feature. After first making adjustments based on differences in home characteristics (e.g. size, age, view, and condition), the difference between the sales prices attributed to the study feature is isolated. Therefore, if properly applied, a paired sales analysis can reflect the market's reaction to a given feature.

The reliability of the paired sales analysis is based on the number and quality of the pairs. In most appraisal reports, appraisers are fortunate to find one good pair to support an adjustment, while multiple pairs add credibility to the study's results. While all pairs are not expected to yield the same results, as homebuyers vary in the price premiums they are willing to pay, a study that reveals a wide range of premiums may lead to inconclusive results. On the other hand, when pairs result in a tight range of premiums, the result is most convincing and accepted in the valuation profession.

Paired sales analysis is difficult and time consuming for the following reasons:

- Few sales of almost identical properties, in the same area, selling within a reasonable period, occur on a regular basis.
- In the D.C. market, few HPHs were identified in the MLS even though data from District third-party programs indicate that 625 certified HPHs have been built since 2000.
- The lack of supporting attachments in MRIS creates difficulty in understanding the shade of green for HPHs. A third-party certification provides some degree of clarity, but obtaining the certification and score sheet is challenging and sometimes not

possible if these documents are not attached in the MLS, as the documentation is often lost after the first property transfer, and in most cases is not available through a public data source. LEED-certified properties may be verified through the USGBC website, but the score sheets are not always available.

- Most pairs require other adjustments for non-study features. These adjustments must also be quantifiable with solid basis in the market, or the results are less credible.

MARKET VALUE DEFINED

“Market Value is defined as the most probable price which a property should bring in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus. Implicit in this definition are the consummation of a sale as of a specified date and the passing of title from seller to buyer under conditions whereby:

- Buyer and seller are typically motivated;
- Both parties are well informed or well advised, and acting in what they consider their own best interests;
- A reasonable time is allowed for exposure in the open market;
- Payment is made in terms of cash in U.S. dollars or in terms of financial arrangements comparable thereto; and,
- The price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granted by anyone associated with the sale.”

Source: [Federal Register/Interagency Appraisal and Evaluation Guidelines](#)

2.3 Cost Approach

The cost approach involves estimating the installed cost of green features. A typical buyer would consider the replacement cost of green features as of the date they are considering the home purchase. Therefore, appraisers must use cost estimates as of the date of sale or appraised value (e.g. date appraiser estimates value), and not the date built or installed. The cost of green features has declined for some products, and their net cost is often reduced by incentives or rebates to a price the market is more willing to accept. The net cost of green features is the most often quoted price.

Identifying the costs of green features for a specific property, and especially for existing homes, is difficult. The cost of green will vary

by location based on the local building code. For instance, some building codes already have a light shade of green; the green cost premiums in such cases would be lower than those in an area where the code has not adopted some shade of green.⁷ For this study, the authors chose [McGraw Hill Construction's 2014 national report](#), which reported the following statistics on the incremental cost of green features based on a national poll of builders, developers, and single-unit remodelers:

- For builders and developers of new homes where green projects represent 30 percent or more of total projects, the green cost premium is 5.7 percent. For those builders where green projects are less than 30 percent of total projects, the cost premium is 8 percent.
- For single-unit remodelers where green projects exceed 30 percent of their total work, the average incremental cost to add green features is 7.5 percent. Remodelers that do less than 30 percent green projects have an average green cost premium of 9.5 percent.

2.4 Income Approach

The income approach⁸ is a useful tool to value properties or specific items that have a quantifiable income stream by discounting that stream to its present value. The approach is most relevant in valuing rental property, or other assets that have a positive cash flow.

Properties with energy-efficient features (one of the six elements of green building) often have Home Energy Rating System (HERS) reports that provide estimated energy savings that can be used in the income approach to assess the value of the energy features. This approach requires the appraiser to access the entire HERS report or somehow measure the energy savings of the property. Ideally, the appraiser would compare the energy use of the property being appraised to the energy use of the comparables identified from the sales comparison approach. The difference in energy savings between the subject property and the comparable sales can be developed into a contributory value using the income approach.

Fannie Mae's preferred method of applying the income approach to develop an energy-efficient adjustment is to use the difference in monthly rent between a HPH rental and a non-HPH rental (assuming

⁷ Cost to build new home to green standards less the cost to build new home to code equals the cost premium for green features. This formula illustrates that if the code is already some shade of green, the cost premium for green features will be lower than a premium in an area where the building code is not a shade of green.

⁸ Also known as the income capitalization approach.

the HPH monthly rent is greater than the non-HPH monthly rent). This resulting monthly rental premium for the HPH can then be multiplied by a monthly gross rent multiplier (GRM)⁹ to arrive at a contributory value of the energy features:

$$\text{GRM} \times \text{Rental Premium} = \text{Contributory Value of Green Features.}$$

Once developed, the income approach result should be compared to depreciated cost and paired data, if available, to form an opinion of the contributory value for the green features.

Given the essential nature of obtaining energy use and cost data for this preferred method of analysis, one can understand the challenge appraisers have using this approach when the MLS data (the best source available to appraisers) does not provide this type of information.

2.5 Data Collection

This study uses appraisal methodology to develop an opinion of how HPH sales prices compared to similar non-HPH sales prices in the Washington, D.C. market. The residential properties identified as having green features include row houses, high-rise condominiums, townhouses, multi-unit “boutique” complexes, and single-unit detached houses.

MRIS provided IMT and Adomatis Appraisal Service with the MLS sales that included green features and were certified by LEED or ENERGY STAR. A search conducted between January 2013 and June 2015 resulted in 32 HPH sales, which became the dataset for this study. The local appraiser, Mr. Boucher, was tasked with the following:

1. Research the MLS sales identified to establish that they met the definition of market value;
2. Review and compare MLS data to the public record data on HPH sales and other sales used in the analysis;
3. Provide the MLS listing sheets and public record data to support the paired sales analysis tables;
4. Develop credible paired sales to estimate any differences in value between the sales with green features and similar sales without green features;
5. Collect the days on the market for all transactions and identify those sales with green features that were not marketed in the

⁹ The gross rent multiplier is a relationship between the monthly rental amount and the sales price: $\text{GRM} = \text{Sale price} / \text{monthly rent}$.

MLS as having green features. This will provide an understanding of how well the green features were marketed;

6. Obtain the green rating sheets and energy ratings where possible;
7. Drive by each sale used in the study to understand view and locational issues such as busy and one-way streets, as well as commercial influences that may affect sales prices.

Mr. Boucher determined that all sales provided met the definition of market value; none were the result of foreclosure or short sale. While good marketing is implied by the market value definition, if the listing did not identify the home's green features then good marketing did not occur. As identified in the prior District study,¹⁰ most HPH sales listed in the MLS are not completely or accurately identifying green features.

Mr. Boucher determined if the identified HPH sales could be paired with comparable non-HPH sales in the same area, of similar type, and that occurred around the same time. The HPH sales that could not be paired were eliminated. Of the 32 HPH sales provided to the appraiser, 24 (75 percent) were eliminated because no comparable non-HPH sales were found.

Market data is imperfect and thus appraisers are required to make adjustments for feature differences. Mr. Boucher chose the most similar sales and then applied adjustments based on the local market's reaction to feature differences. Ms. Pappas reviewed all paired sales and adjustments to form an opinion from more than one appraiser in this market. The features requiring adjustment in the pairings included the following:

1. Site size
2. Location
3. View
4. Age
5. Bath count
6. Living area
7. Basement finish/size
8. Amenities such as porches, patio, decks
9. Floor location
10. Parking

¹⁰ IMT, Elevate Energy, MRIS, and Department of Energy and Environment, *Greening the MLS: Bringing High-Performance Homes to Light in the District of Columbia*, (Washington, D.C., 2015).

11. Sales concessions by seller to buyer
12. Common elements

Not every pair required all of these adjustments. The list is a compilation of all feature differences requiring adjustment in one or more pairs. Overall, the gross and net adjustments were minimal, indicating the data are comparable. The gross adjustment is the sum of all adjustments in a paired sale regardless of the direction of the adjustment (positive or negative).

Table 3: Summary of Gross Adjustments for Pairings

Summary of Gross Adjustments for Pairings	
Range	0.8% to 24.3%
Mean	10.91%
Median	10.85%
Mode	11.80%

3. Residential Property Types

Figure 1: Single-Unit Detached. A dwelling that is designed for occupancy by one family.¹¹



¹¹ Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 5th ed. (Chicago: Appraisal Institute, 2010).

Figure 2: Row House. An attached house in a row of architecturally uniform houses separated by party walls and covered by a continuous roof.¹²



Figure 3: Townhouse. A single-unit dwelling attached to a series of similar dwellings by common walls. Typically, this design does not exceed three stories, and only the end units have side yards.¹³



¹² Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 5th ed. (Chicago: Appraisal Institute, 2010).

¹³ Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 5th ed. (Chicago: Appraisal Institute, 2010).

Figure 4: High-Rise Condominium. A form of ownership in which each owner has the right to use and occupy an allotted unit plus common areas.



Figure 5: Boutique. The term “boutique” is not a formal design style but a description of a complex with a small number of units. They typically have few common amenities and offer a living environment that might be considered more similar to a single-unit dwelling that was converted to multi-unit use.¹⁴



¹⁴ Donald Boucher, SRA.

4. Data Summary

The complete dataset for this analysis consisted of 32 HPH transactions and 32 non-HPH (comparable) transactions. These data are listed in the following two tables: Table 4 lists the HPH transactions and Table 5 lists the non-HPH transactions.

Table 4: HPH Sales

#	ZIP Code 200**	Type	Close Date	Close Price	\$/SF LA	Living Area	Green Cert. or Features	DOM	Age
1	05	HR	3/1/13	\$442,000	\$552.50	800	LEED	3	7
2	05	HR	4/29/13	\$440,000	\$549.31	801	LEED	25	7
3	05	HR	5/31/13	\$265,000	\$598.19	443	LEED	55	7
4	05	HR	5/31/13	\$425,000	\$530.59	801	LEED	8	7
5	17	TH	6/26/13	\$622,000	\$344.60	1805	LEED	78	2
6	09	MR	7/5/13	\$599,000	\$569.39	1052	LEED	11	4
7	11	RA	7/12/13	\$725,000	\$483.33	1500	LEED	35	90
8	03	RA	7/16/13	\$885,000	\$523.05	1692	LEED	6	3
9	03	TH	8/5/13	\$870,000	\$514.18	1692	LEED	16	4
10	05	HR	10/4/13	\$599,900	\$700.82	856	LEED	5	7
11	01	RA	1/15/14	\$817,000	\$566.97	1441	LEED	9	99
12	11	RA	1/29/14	\$317,000	\$372.07	852	LEED	20	96
13	09	MR	3/31/14	\$739,000	\$580.97	1272	LEED	26	5
14	10	RA	6/20/14	\$661,500	\$606.88	1090	LEED	5	104
15	11	RF	9/6/14	\$780,000	\$453.49	1720	LEED	67	91
16	17	RA	11/21/14	\$790,000	\$390.12	2025	LEED	9	2
17	17	RA	12/8/14	\$775,000	\$361.81	2142	LEED	26	3
18	05	HR	12/22/14	\$280,000	\$632.05	443	LEED	3	8
19	11	D	1/16/15	\$1,415,000	\$289.96	4880	LEED	55	4
20	17	RA	2/27/15	\$716,000	\$146.72	4880	LEED	6	4
21	18	TH	4/1/15	\$476,050	\$297.53	1600	Features	7	1
22	05	HR	4/13/15	\$295,000	\$665.91	443	LEED	13	9
23	03	TH	4/17/15	\$950,000	\$420.35	2260	LEED	19	5
24	05	HR	4/24/15	\$469,000	\$602.83	778	LEED	14	9
25	18	TH	4/24/15	\$526,185	\$276.94	1900	Features	138	0
26	05	HR	5/21/15	\$469,000	\$593.67	790	LEED	7	9
27	17	TH	5/27/15	\$759,000	\$421.67	1800	LEED	35	2
28	03	RA	5/29/15	\$979,100	\$580.72	1686	LEED	25	4
29	17	RA	5/29/15	\$808,000	\$374.07	2160	LEED	5	2
30	12	D	6/4/15	\$750,000	\$520.47	1441	Features	4	90
31	05	HR	6/16/15	\$575,000	\$598.96	960	LEED	15	9
32	01	HR	6/22/15	\$599,000	\$689.30	869	LEED	4	2
				Mean	\$650,585	\$494	1,527	24	22
				Median	\$641,750	\$527	1,441	14	6
				Mode	\$599,000	N/A	443	5	7

HR: High-Rise 9+ Floors

MD: Mid-Rise 5–8 Floors

RA: Row House/Attached

TH: Townhouse

RF: Row House/Federal

D: Detached

DOM: Days on Market

Note: Of these 32 HPH sales, the 8 highlighted sales could be paired with 3 or more non-HPH sales. Tables 4 and 5 contain the date the sale closed, but for analysis the contract date is used since that is the date the price was negotiated.

Table 5: Non-HPH Sales

#	Paired Sale #	ZIP Code 200**	Style	Contract Date	Sold Price	\$/SF	Living Area	Age	DOM	Retrofit
1	1-1	11	RH	5/13/13	\$675,000	\$453.63	1,488	92	0	R
2	1-2	11	RH	2/6/13	\$700,500	\$427.13	1,640	86	5	R
3	1-3	11	SD	3/18/13	\$689,900	\$407.26	1,694	104	0	R
4	1-4	11	RH	4/26/13	\$685,000	\$428.13	1,600	96	7	R
5	1-5	11	RH	4/28/13	\$660,000	\$458.33	1,440	91	5	R-3
6	2-1	11	RH	8/13/14	\$700,000	\$575.66	1,216	103	5	R
7	2-2	11	RH	8/5/14	\$725,000	\$416.67	1,740	104	18	R
8	2-3	11	RH	4/15/14	\$705,000	\$410.84	1,716	107	5	R
9	3-1	12	B	3/4/15	\$710,000	\$401.58	1,768	88	6	R-4
10	3-2	12	B	11/7/14	\$729,000	\$365.23	1,996	88	42	R
11	3-3	12	C	10/10/14	\$740,000	\$334.84	2,210	88	29	R
12	4-1	05	HR	12/16/14	\$474,000	\$634.54	747	10	60	No
13	4-2	01	HR	9/11/14	\$456,000	\$589.91	773	9	7	No
14	4-3	05	HR	3/15/15	\$480,000	\$645.16	744	11	4	No
15	4-4	01	HR	12/7/14	\$475,000	\$662.48	717	9	24	No
16	5-1	10	2 U	3/2/14	\$675,000	\$443.79	1521	110	52	R-5
17	5-2	10	4 U	5/10/14	\$547,000	\$594.57	920	92	16	R
18	5-3	10	3 U	12/11/13	\$663,650	\$510.50	1300	83	7	R-26
19	5-4	09	5 U	11/1/13	\$599,000	\$617.53	970	88	9	R-7
20	6-1	11	3 U	10/23/13	\$307,000	\$365.04	841	108	5	R-3
21	6-2	12	31 U	11/27/13	\$295,000	\$325.25	907	84	0	R-5
22	6-3	12	12 U	12/2/13	\$317,500	\$364.94	870	90	0	R
23	6-4	11	17 U	12/7/13	\$340,000	\$298.77	1,138	90	5	R-9
24	7-1	04	HR	4/13/15	\$465,000	\$533.26	872	12	20	No
25	7-2	01	HR	2/25/15	\$475,000	\$631.65	752	11	34	No
26	7-3	01	HR	1/21/15	\$522,600	\$586.53	891	7	0	No
27	7-4	04	HR	1/8/15	\$500,000	\$545.85	916	9	56	No
28	8-1	09	2 U	6/11/13	\$730,000	\$564.14	1,294	103	4	R-5
29	8-2	09	7 U	2/12/13	\$811,000	\$665.30	1,219	115	8	R-7
30	8-3	01	12 U	6/16/13	\$837,000	\$525.42	1,593	4	0	No
31	8-4	09	8 U	4/10/13	\$816,000	\$553.60	1,474	5	19	No
32	8-5	09	3 U	9/19/13	\$865,000	\$613.91	1,409	88	49	R
Mean					\$605,317	\$498	1262	68	16	
Median					\$669,325	\$518	1257	88	7	
Mode					\$675,000	#N/A	#N/A	88	0	

HR: High-Rise 9+ Floors
B: Bungalow

SD: Semi-Detached
C: Colonial

RH: Row House
U: Unit

DOM: Days on Market

R: New Retrofit

R + #: Retrofit # Years Ago

Note: These 32 sales are the most similar non-HPH sales identified for pairing with the 8 HPH sales highlighted in Table 4.

5. Results

A note to readers: The sales price premiums identified in this study are based on a specific date (date of sale) and for a given geographical location (Washington, D.C.). Applying the sales price premiums revealed in this study to other areas or periods should be done only if the geographical areas have similar demographics, climate, and market conditions. Just as stocks in the stock market fluctuate, so do the prices of real estate and its features. This study's dataset includes sales occurring between January 2013 and June

2015, and it may not be appropriate to apply these premiums to sales outside this timeframe.

5.1 Paired Sales Analysis

Eight out of 32 HPH sales could be paired with similar non-HPH sales to develop credible results without excessive adjustments. Each of the eight HPH sales was paired with three or more non-HPH sales that were similar in all aspects except green features. The differences in sales prices provide an understanding of the market's reaction to green features. It is difficult to pull apart the premium and assign value to each of the green components; however, when solar PV systems are included, an income-based adjustment can be developed to estimate the portion of the total green premium attributable to the solar PV system.

Since six of the eight HPHs are LEED certified, the following table is presented to explain the point differences for the levels of LEED certification. LEED projects must meet a set of prerequisites and accumulate additional points to meet the certification levels outlined below. In general, higher point totals indicate a greater number of green features and, thus, a higher green standard. In addition, a higher level of certification usually means more cost to build. In most cases, buyers are not knowledgeable of the LEED point system, which thus does not factor into their buying decision.

Table 6: Points Needed to Attain Various LEED Certification Levels

Number of points a project earns determines the level of LEED certification	
LEED Certified – Pair 4	40–49 Points
LEED Silver – Pairs 5,7	50–59 Points
LEED Gold	60–79 Points
LEED Platinum – Pairs 1, 2, 6	80+ Points

Source: <http://www.usgbc.org/LEED/>. Note: These points are based on LEED v4 (the newest version), but the HPHs' point totals vary with the LEED version at time of certification. For instance, HPH 4 had only 29 points and was certified under a previous version of LEED.

In the paired sales exhibited on the following pages, the HPH sales are also identified as the subjects of the pairing analysis.

Table 7: Summary of Sales Price Premiums Based on the 32 Pairs

#	Paired Sale #	ZIP Code 200**	Style	Contract Date	DOM	Sold Price	Adj. Sale Price	Living Area	SPP	PRE	Age	Retrofit
1	1-1	11	RH	5/13/13	0	\$675,000	\$695,500	1,488	\$29,500	4.07%	92	R
2	1-2	11	RH	2/6/13	5	\$700,500	\$688,500	1,640	\$36,500	5.03%	86	R
3	1-3	11	SD	3/18/13	0	\$689,900	\$705,900	1,694	\$19,100	2.63%	104	R
4	1-4	11	RH	4/26/13	7	\$685,000	\$706,500	1,600	\$18,500	2.55%	96	R
5	1-5	11	RH	4/28/13	5	\$660,000	\$708,000	1,440	\$17,000	2.34%	91	R-3
6	2-1	11	RH	8/13/14	5	\$700,000	\$761,500	1,216	\$18,500	2.37%	103	R
7	2-2	11	RH	8/5/14	18	\$725,000	\$759,500	1,740	\$20,500	2.63%	104	R
8	2-3	11	RH	4/15/14	5	\$705,000	\$756,500	1,716	\$23,500	3.01%	107	R
9	3-1	12	B	3/4/15	6	\$710,000	\$713,500	1,768	\$36,500	4.87%	88	R-4
10	3-2	12	B	11/7/14	42	\$729,000	\$704,000	1,996	\$46,000	6.13%	88	R
11	3-3	12	C	10/10/14	29	\$740,000	\$697,000	2,210	\$53,000	7.07%	88	R
12	4-1	05	HR	12/16/14	60	\$474,000	\$470,000	747	-\$1,000	-0.21%	10	No
13	4-2	01	HR	9/11/14	7	\$456,000	\$455,000	773	\$14,000	2.99%	9	No
14	4-3	05	HR	3/15/15	4	\$480,000	\$471,000	744	-\$2,000	-0.43%	11	No
15	4-4	01	HR	12/7/14	24	\$475,000	\$467,250	717	\$1,750	0.37%	9	No
16	5-1	10	2 U	3/2/14	52	\$675,000	\$644,500	1521	\$17,000	2.57%	110	R-5
17	5-2	10	4 U	5/10/14	16	\$547,000	\$642,000	920	\$19,500	2.95%	92	R
18	5-3	10	3 U	12/11/13	7	\$663,650	\$645,150	1300	\$16,350	2.47%	83	R-26
19	5-4	09	5 U	11/1/13	9	\$599,000	\$641,000	970	\$20,500	3.10%	88	R-7
20	6-1	11	3 U	10/23/13	5	\$307,000	\$305,860	841	\$11,140	3.51%	108	R-3
21	6-2	12	31 U	11/27/13	0	\$295,000	\$300,000	907	\$17,000	5.36%	84	R-5
22	6-3	12	12 U	12/2/13	0	\$317,500	\$311,500	870	\$5,500	1.74%	90	R
23	6-4	11	17 U	12/7/13	5	\$340,000	\$306,000	1,138	\$11,000	3.47%	90	R-9
24	7-1	04	HR	4/13/15	20	\$465,000	\$545,000	872	\$54,000	9.02%	12	No
25	7-2	01	HR	2/25/15	34	\$475,000	\$557,500	752	\$41,500	6.93%	11	No
26	7-3	01	HR	1/21/15	0	\$522,600	\$554,600	891	\$44,400	7.41%	7	No
27	7-4	04	HR	1/8/15	56	\$500,000	\$554,000	916	\$45,000	7.51%	9	No
28	8-1	09	2 U	6/11/13	4	\$730,000	\$793,500	1,294	\$23,500	2.88%	103	R-5
29	8-2	09	7 U	2/12/13	8	\$811,000	\$800,000	1,219	\$17,000	2.08%	115	R-7
30	8-3	01	12 U	6/16/13	0	\$837,000	\$805,000	1,593	\$12,000	1.47%	4	No
31	8-4	09	8 U	4/10/13	19	\$816,000	\$806,000	1,474	\$11,000	1.35%	5	No
32	8-5	09	3 U	9/19/13	49	\$865,000	\$804,000	1,409	\$13,000	1.59%	88	R
					Mean	16	\$605,317	\$617,977	1262	\$22,211	3.46%	68
					Median	7	\$669,325	\$666,825	1257	\$18,500	2.91%	88
					Mode	0	\$675,000	#N/A	#N/A	\$17,000	#N/A	88

HR: High-Rise 9+ Floors
B: Bungalow

SD: Semi-Detached
C: Colonial

RH: Row House
U: Unit

DOM: Days on Market

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

R: New Retrofit

R + #: Retrofit # Years Ago

Note. The contract date is the date the contract was signed and price negotiated between the parties.

Table 8: HPH Sales Paired with the Non-HPH Sales Identified in Table 7

Paired Sale #	ZIP Code 200**	Style	Contract Date	DOM	Sold Price	\$/SF	Living Area	Level of Green	ADV	Age	Retrofit
P-1	11	RH	6/20/13	35	\$725,000	\$477	1,520	LEED + Solar PV	Yes	92	R
P-2	11	RH	8/12/14	67	\$780,000	\$453	1,720	LEED Platinum	Yes	92	R
P-3	12	CM	5/12/15	4	\$750,000	\$520	1,441	Green Features + Solar PV	Yes (No solar size)	90	R
P-4	05	HR	4/10/15	14	\$469,000	\$603	778	LEED Certified	Yes	9	No
P-5	10	4 U BQ	5/20/14	5	\$661,500	\$607	1,090	LEED + Solar PV*	Yes	104	R-3
P-6	11	3 U BQ	12/29/13	20	\$317,000	\$372	852	LEED Platinum	Yes	97	R-3
P-7	01	HR	5/16/15	4	\$599,000	\$689	869	LEED Silver	No	2	No
P-8	01	2 U BQ	10/15/13	9	\$817,000	\$567	1,441	Built to LEED (not certified)	Yes	99	R-5
Mean				20	\$639,813	\$536	1,214			73	
Median				12	\$693,250	\$544	1,266			92	

* For P-5, solar PV is not owned by the unit

HR: High-Rise 9+ Floors

CM: Craftsman

RH: Row House

U: Unit

BQ: Boutique

ADV: Listing Advertised Green Features

DOM: Days on Market

R: New Retrofit

R + #: Retrofit # Years Ago

Note: The sales listed in this table are the HPH sales used in the following paired sales tables. For instance, Pair 1 (also P-1) is identified in the tables below as the HPH sale, and the non-HPH sales compared to P-1 are identified as S-1, S-2, etc.

The yellow highlighted sales had green features but were not formally certified by a third-party organization. It is not clear if those homes listed as “built to LEED” actually attained a specific LEED certification level.

5.1.1 Paired Sale 1

Table 9: Paired Sale 1

Paired Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area (SF)	SPP	PRE	Age
Paired Sale 1			LEED Platinum, 6 kW Solar PV						
P-1	6/20/13	35	\$725,000			1,520			92
S-1	5/13/13	0	\$675,000	\$695,500	7.20%	1,488	\$29,500	4.07%	92
S-2	2/6/13	5	\$700,500	\$688,500	6.00%	1,640	\$36,500	5.03%	86
S-3	3/18/13	0	\$689,900	\$705,900	12.50%	1,694	\$19,100	2.63%	104
S-4	4/26/13	7	\$685,000	\$706,500	4.90%	1,600	\$18,500	2.55%	96
S-5	4/28/13	5	\$660,000	\$708,000	7.90%	1,440	\$17,000	2.34%	91
Pair 1 - Premium Results									
Subject - HPH Sale		35	\$725,000			1,520			92
Mean		3	\$682,080	\$700,880	7.70%	1,572	\$24,120	3.33%	94

Gross Adj.: Sum of all adjustments regardless of direction of adjustment

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: [USGBC](#) verified the HPH sale (P1) as LEED Platinum certified, receiving 99.5 points in August 2013. The five sales compared to P1 support a mean sales price premium of 3.33 percent for the green features, which include a 6kW solar PV system. The premium range is \$17,000–\$36,500.

Income Approach for Solar PV System


When a property has a solar PV system,¹⁵ the energy produced by the system can be used to determine its contributory value by employing a method known as discounted cash flow analysis. A discounted cash flow analysis was performed utilizing the web-based program PV Value® to determine the portion of the green premium that is attributable to the solar PV system. This value can then be compared to the total green premium to isolate the contributory value of the green features other than solar PV. This approach allows the green premium to be compared more fairly with the other pairs that do not have solar PV systems.

This property has a 6kW (6,000 watt) system according to the MLS. Aerial mapping provided sufficient information on the system's orientation so that the PV Value calculation could be completed. Using the income approach, the value of the solar PV system was estimated to range from \$13,698-\$16,383 (or \$2.28-\$2.73 per watt).

The following worksheet provides the inputs and results of the income and cost approaches using PV Value.

¹⁵ As of September 2, 2015, there were [1,096 listed](#) solar PV systems located in Washington, D.C.

Figure 6: PV Value, Paired Sale 1

		Beta Version 0.8.1	File #:	Appraiser Indicated Value:	\$13,800.00	\$2.30 /watt	
09/14/15 5:47:04 PM		NA		Report Prepared By:	Sandra Adomatis		
Subject Property Data							
Address: [REDACTED]							
City:	D.C.	State:	DC	Zip Code:	20011		
Property Type:	Residential	PV Project Type:	Existing	PV Ownership:	Owned		
Cost Approach Method Physical Age / Life Depreciated Cost							
Source:	User 8-1-15	DC	Gross Replacement Cost New:	\$19,800.00	\$3.30 /watt		
Life:	25		Straight Line Depreciation:	\$0.00	\$0.00 /watt/yr		
Age:	0		Accumulated SL Depreciation:	\$0.00	\$0.00 /watt		
Additional Depreciation:			None	\$	/watt		
Additional Depreciation:			Other Depreciation - All forms of loss	\$6,000.00	\$1.00 /watt		
Estimated Depreciated Value			Cost Approach:	\$13,800.00	\$2.30 /watt		
Income Approach Method Energy Value DCF							
Solar Resource		O & M Expense		Utility Rate			
System Size Watts:	6,000	Inverter Size Watts:	5,200	NREL Utility Co:	Potomac Electric Power Co		
Module Warranty Yrs:	25	Inverter Warranty Yrs:	15	NREL Utility Rate:	10.98 ¢/kWh		
System Age Yrs:	0	Inverter Age Yrs:	0	User Provided Utility Rate:	- ¢/kWh		
Remaining Yrs:	25	Inverter Replaced:	No	Utility Rate Used:	10.98 ¢/kWh		
Derate Factor:	0.77	Inverter Replacement Cycle Yrs:	15	EIA Escalation Rate:	3.90% CAGR		
Degradation Rate:	0.50%	Inverter Replacement Cost		User Provided Esc Rate:	- % CAGR		
Array Tilt:	26.6 °	Survey Data:	55 ¢/W	Escalation Rate Used:	3.90% CAGR		
Array Azimuth:	180 °	User Provided:	- ¢/W	Comments:			
Annual kWh Est:	7,139	Replacement Cost Used:	55 ¢/W	Incentives offset depreciation. Market is not willing to pay gross cost. Fed. Tax Credits are not included in incentive amount.			
		O & M Exp (future):	\$3,300.00				
		O & M Exp (discounted):	\$1,633.41				
Cost of Capital							
WACC Used		+	Risk Premium	=	Discount Rate	→ Estimated Energy Value / Income Approach	
Fannie Mae Date:	September 14, 2015		200 Basis Points		5.55%	\$13,697.66	
Fannie Mae Rate:	30 Yr 30 day 3.55%		125 Basis Points		4.80%	\$14,959.47	
User Provided Interest Rate:	- %		50 Basis Points		4.05%	\$16,383.10	
Estimate of Accumulated Energy Production / Income Approach							
Year	Annual kWh	Low Estimated Value		Avg Estimated Value		High Estimated Value	
		Annual Value	Accumulated Value	Annual Value	Accumulated Value	Annual Value	Accumulated Value
1	7,103	779.94	779.94	779.94	779.94	779.94	779.94
2	7,068	763.89	1,543.84	769.36	1,549.30	774.90	1,554.85
3	7,032	748.15	2,291.99	758.90	2,308.20	769.88	2,324.73
4	6,996	732.72	3,024.71	748.56	3,056.77	764.87	3,089.59
5	6,961	717.59	3,742.29	738.35	3,795.11	759.87	3,849.46
6	6,925	702.75	4,445.04	728.25	4,523.37	754.88	4,604.34
7	6,889	688.19	5,133.23	718.28	5,241.65	749.91	5,354.25
8	6,853	673.93	5,807.16	708.42	5,950.07	744.95	6,099.20
9	6,818	659.94	6,467.09	698.68	6,648.74	740.00	6,839.20
10	6,782	646.22	7,113.31	689.05	7,337.80	735.06	7,574.26
11	6,746	632.77	7,746.08	679.54	8,017.33	730.14	8,304.40
12	6,711	619.58	8,365.66	670.14	8,687.47	725.23	9,029.63
13	6,675	606.65	8,972.31	660.85	9,348.32	720.33	9,749.96
14	6,639	593.97	9,566.29	651.67	9,999.99	715.45	10,465.41
15	6,604	581.55	10,147.83	642.60	10,642.59	710.58	11,175.98
16	6,568	569.36	9,083.78	633.64	9,642.82	705.72	10,248.29
17	6,532	557.41	9,641.20	624.78	10,267.61	700.87	10,949.16
18	6,496	545.70	10,186.90	616.03	10,883.64	696.03	11,645.19
19	6,461	534.22	10,721.12	607.39	11,491.03	691.21	12,336.40
20	6,425	522.96	11,244.08	598.84	12,089.87	686.40	13,022.81
21	6,389	511.93	11,756.01	590.40	12,680.27	681.60	13,704.41
22	6,354	501.11	12,257.12	582.06	13,262.33	676.82	14,381.23
23	6,318	490.51	12,747.63	573.82	13,836.15	672.05	15,053.27
24	6,282	480.11	13,227.74	565.68	14,401.83	667.29	15,720.56
25	6,247	469.92	13,697.66	557.64	14,959.47	662.54	16,383.10
26	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-
Use of this form is subject to the PV Value® terms of use agreement www.pvvalue.com							
©2014 Energy Sense Finance, LLC 3825 Henderson Blvd., Ste. 300, Tampa FL 33629 www.energysensefinance.com							

PV Value requires specific inputs to create a credible value opinion. The basis for each input is explained below.

- **Tilt:** The roof pitch was estimated based on aerial mapping.
- **Orientation:** The orientation was based on aerial mapping.

- **Warranty term** (considered equal to the useful life of the system and the term for discounting the cash flows): The typical warranty term is reported at 20-30 years with most systems having a warranty term of 25 years according to Sandia National Laboratory, Solar City, SunRun, and other solar sales companies. The warranty term is used because it closely mirrors the roof covering life. A 25-year term is used for discounting the energy produced.
- **Utility Rate:** The utility rate including taxes, shown in the PV Value worksheet, was verified verbally by Potomac Electric Power Company (PEPCO). It is important to use accurate utility rates as it can materially affect the value conclusion.
- **Utility Escalation:** The utility escalation rate is tied to the remaining system lifetime. PV Value uses the U.S. Energy Information Administration (EIA)¹⁶ data on utility rates to calculate the escalation rate. Since this system has a 25-year useful life estimate, a rate based on the compound annual growth rate over the past 25 years is applied.
- **Discount Rate:** The discount rate is based on the current Fannie Mae 30-year, 90-day, fixed-rate mortgage plus a 50–200 basis point spread to account for the risk that cash flow projections may not be fully realized. Unlike commercial investors, the typical residential buyer does not consider discount rates. Appraisers must consider how homeowners view the alternative rate they might receive for an investment with similar risk factors. Ms. Adomatis reports that interactions with other appraisers and homeowners indicate that most residential owners consider rates similar to the current mortgage rate, or the second or equity line of credit mortgage rate. Further study is needed to develop residential discount rates from transactions in given markets.

Cost Approach for Solar PV System

When employing the cost approach to value solar PV, it is important to understand the following terms:

- **Cost New:** The gross cost new is based on a Solar Energy Industries Association (SEIA) June 2015 report¹⁷ of residential solar PV costs, in addition to a local builder's report on a recent purchase.

¹⁶ <http://www.eia.gov/electricity/data/state/>.

¹⁷ <http://www.seia.org/research-resources/solar-market-insight-report-2015-q1>.

- **Depreciation:** Depreciation is the difference between cost new and the amount the market is willing to pay. The system for this HPH sale is assumed new since the property was recently renovated. However, it is possible to have depreciation even with a new product. The solar PV system's depreciation is difficult to establish with market data. Based on a recent study published by Lawrence Berkeley National Laboratory, *Selling Into the Sun: Price Premium Analysis of a Multi-State Dataset of Solar Homes*,¹⁸ the contributory value of solar PV is similar to the net cost¹⁹ of the system. This finding suggests that incentives are currently offsetting any depreciation that might apply.

The 30 percent federal tax credit is not included in the depreciation amount. Excluding this tax credit, a local builder reports incentives of \$0.96 per watt, and a solar sales company reports \$1 per watt. For this study, \$1 per watt is applied for the depreciation. Based on the cost approach, the 6kW system was valued at \$13,800.

Green Premium Excluding the Solar PV System

The 6kW solar PV system is valued at \$13,800 based on the cost and income approaches to value. The reconciled value is equal to the cost approach value and falls at the lower end of the range determined using the income approach.

For this HPH, the mean green premium is \$24,143. Deducting the indicated solar PV value from this overall green premium reveals a green feature premium, excluding solar PV, of \$10,343.²⁰

¹⁸ <http://emp.lbl.gov/publications/selling-sun-price-premium>.

¹⁹ Net cost is defined as gross cost less any incentives.

²⁰ \$24,143 (total green premium) - \$13,800 (solar PV premium) = \$10,343 (green feature premium).

5.1.2 Paired Sale 2

Table 10: Paired Sale 2

Paired Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area (SF)	SPP	PRE	Age
Paired Sale 2			LEED Platinum						
P-2	8/12/14	67	\$780,000			1,720			92
S-1	8/13/14	15	\$700,000	\$761,500	11.80%	1,216	\$18,500	2.37%	103
S-2	8/5/14	18	\$725,000	\$759,500	5.60%	1,740	\$20,500	2.63%	104
S-3	4/15/14	5	\$705,000	\$756,500	8.70%	1,716	\$23,500	3.01%	107
Pair 2 - Premium Results									
Subject - HPH Sale		67	\$780,000			1,720			92
Mean		9	\$710,000	\$759,167	8.70%	1,557	\$20,833	2.67%	105

Gross Adj.: Sum of all adjustments regardless of direction of adjustment

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: [USGBC](#) verified this HPH sale as LEED Platinum certified, receiving 93 points in August 2015. Apparently, certification was in process when this property went under contract. The three sales compared to the HPH sale support a mean sales price premium of 2.67 percent.

The premium range of 2.37-3.01 percent of the sales price is extremely tight and equates to a dollar premium range between \$18,500–\$23,500.

5.1.3 Paired Sale 3

Table 11: Paired Sale 3

Paired Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area (SF)	SPP	PRE	Age
Paired Sale 3			Green Features + Solar PV						
P-3	5/12/15	4	\$750,000			1,441			90
S-1	3/4/15	6	\$710,000	\$713,500	11.80%	1,768	\$36,500	4.87%	88
S-2	11/7/14	42	\$729,000	\$704,000	10.70%	1,996	\$46,000	6.13%	88
S-3	10/10/14	29	\$740,000	\$697,000	15.70%	2,210	\$53,000	7.07%	88
Pair 3 - Premium Results									
Subject - HPH Sale		4	\$750,000			1,441			90
Mean		26	\$726,333	\$704,833	12.73%	1,991	\$45,167	6.02 %	88

Gross Adj.: Sum of all adjustments regardless of direction of adjustment

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: Three sales similar to this single-unit detached, HPH sale support a higher premium than was found with paired sales 1 and 2.

The mean premium as a percentage of sales price is 6.02 percent, and the premium range is \$36,500–\$53,000. The HPH sale has some green features but a LEED certification could not be verified. The range of premiums is remarkably higher than that of the prior two sales and that is attributed to the 5kW solar PV system that is advertised to produce five to eight Solar Renewable Energy Credits (SRECs) per year over a three-year contract. Over this time period, the SRECs are valued at \$7,500. Besides the energy produced by this solar PV system, the owner may receive income for three years. The additional income the SRECs provide may have influenced the sales price of this HPH, resulting in a higher green premium. A local solar sales company indicated it deducts \$1 per watt from the gross cost of the solar PV system due to the SRECs, rather than have the owner wait three years to receive their credits. The solar sales company would then receive the SRECs over the three-year period.

Income Approach for Solar PV System

Figure 7: Array 1


		Beta Version 0.8.1	File #:	Appraiser Indicated Value:	\$6,000.00	\$2.40 /watt	
09/14/15 5:10:20 PM		NA		Report Prepared By:	Sandra Adomatis		
Subject Property Data							
Address: [REDACTED]							
City:	D.C.	State:	DC	Zip Code:	20012		
Property Type:	Residential	PV Project Type:	Existing	PV Ownership:	Owned		
Cost Approach Method Physical Age / Life Depreciated Cost							
Source:	User 8-1-15 DC	Gross Replacement Cost New:	\$8,250.00	\$3.30 /watt			
Life:	25	Straight Line Depreciation:	\$0.00	\$0.00 /watt/yr			
Age:	0	Accumulated SL Depreciation:	\$0.00	\$0.00 /watt			
Additional Depreciation:		Other Depreciation - All forms of loss	\$2,500.00	\$1.00 /watt			
Additional Depreciation:		None	\$ \$	/watt			
Estimated Depreciated Value		Cost Approach:	\$5,750.00	\$2.30 /watt			
Income Approach Method Energy Value DCF							
Solar Resource		O & M Expense		Utility Rate			
System Size Watts:	2,500	Inverter Size Watts:	2,200	NREL Utility Co:	Potomac Electric Power Co		
Module Warranty Yrs:	25	Inverter Warranty Yrs:	15	NREL Utility Rate:	10.98 ¢/kWh		
System Age Yrs:	0	Inverter Age Yrs:	0	User Provided Utility Rate:	- ¢/kWh		
Remaining Yrs:	25	Inverter Replaced:	No	Utility Rate Used:	10.98 ¢/kWh		
Derate Factor:	0.77	Inverter Replacement Cycle Yrs:	15	EIA Escalation Rate:	3.90% CAGR		
Degradation Rate:	0.50%	Inverter Replacement Cost		User Provided Esc Rate:	- % CAGR		
Array Tilt:	26.6 °	Survey Data:	75 ¢/W	Escalation Rate Used:	3.90% CAGR		
Array Azimuth:	180 °	User Provided:	- ¢/W	Comments: Incentives offset depreciation. Market is not willing to pay gross cost. Fed. Tax Credits are not included in incentives.			
Annual kWh Est:	2,974	Replacement Cost Used:	75 ¢/W				
		O & M Exp (future):	\$1,875.00				
		O & M Exp (discounted):	\$928.07				
Cost of Capital							
WACC Used		+	Risk Premium	=	Discount Rate	Estimated Energy Value / Income Approach	
Fannie Mae Date:	September 14, 2015	200	Basis Points	5.55%	\$5,458.62	\$2.18 /watt	
Fannie Mae Rate:	30 Yr 90 day 3.55%	125	Basis Points	4.80%	\$5,984.27	\$2.39 /watt	
User Provided Interest Rate:	- %	50	Basis Points	4.05%	\$6,577.33	\$2.63 /watt	
Estimate of Accumulated Energy Production / Income Approach							
		Low Estimated Value		Avg Estimated Value		High Estimated Value	
Year	Annual kWh	Annual Value	Accumulated Value	Annual Value	Accumulated Value	Annual Value	Accumulated Value
1	2,959	324.91	324.91	324.91	324.91	324.91	324.91
2	2,944	318.23	643.14	320.50	645.42	322.81	647.73
3	2,929	311.67	954.81	316.15	961.56	320.72	968.45
4	2,915	305.24	1,260.05	311.84	1,273.40	318.63	1,287.08
5	2,900	298.94	1,558.98	307.58	1,580.99	316.55	1,603.63
6	2,885	292.75	1,851.74	303.38	1,884.37	314.47	1,918.10
7	2,870	286.69	2,138.43	299.22	2,183.59	312.40	2,230.50
8	2,855	280.75	2,419.17	295.12	2,478.71	310.33	2,540.83
9	2,840	274.92	2,694.09	291.06	2,769.77	308.27	2,849.11
10	2,825	269.20	2,963.30	287.05	3,056.82	306.22	3,155.32
11	2,810	263.60	3,226.90	283.09	3,339.90	304.17	3,459.49
12	2,796	258.11	3,485.01	279.17	3,619.07	302.12	3,761.61
13	2,781	252.72	3,737.73	275.30	3,894.37	300.08	4,061.69
14	2,766	247.44	3,985.17	271.48	4,165.85	298.04	4,359.73
15	2,751	242.26	4,227.43	267.70	4,433.54	296.01	4,655.75
16	2,736	237.19	4,464.62	263.96	4,697.50	293.99	4,949.74
17	2,721	232.21	4,696.83	260.28	4,957.78	291.97	5,241.71
18	2,706	227.33	4,924.16	256.63	5,214.41	289.96	5,531.67
19	2,691	222.55	5,146.71	253.03	5,467.44	287.95	5,820.62
20	2,677	217.86	5,364.57	249.47	5,716.91	285.94	6,108.56
21	2,662	213.26	5,577.83	245.95	5,962.86	283.95	6,395.51
22	2,647	208.75	5,786.58	242.48	6,205.34	281.95	6,681.46
23	2,632	204.34	5,990.92	239.05	6,444.39	279.96	6,966.42
24	2,617	200.01	6,190.93	235.65	6,679.04	277.98	7,250.40
25	2,602	195.76	6,386.69	232.30	6,909.34	276.00	7,533.40
26	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-
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Figure 8: Array 2




	Beta Version 0.8.1	File #:	Appraiser Indicated Value:		\$3,325.00	\$1.90 /watt	
	09/14/15 5:05:51 PM	NA	Report Prepared By:		Sandra Adomatis		
Subject Property Data							
Address: [REDACTED]							
City: D.C.		State: DC		Zip Code: 20012			
Property Type: Residential		PV Project Type: Existing		PV Ownership: Owned			
Cost Approach Method Physical Age / Life Depreciated Cost							
Source: User 8-1-15 DC		Gross Replacement Cost New:		\$5,775.00	\$3.30 /watt		
Life: 25		Straight Line Depreciation:		\$0.00	\$0.00 /watt/yr		
Age: 0		Accumulated SL Depreciation:		\$0.00	\$0.00 /watt		
Additional Depreciation: Other Depreciation - All forms of loss				\$2,450.00	\$1.40 /watt		
Additional Depreciation: None				\$	\$ /watt		
Estimated Depreciated Value		Cost Approach:		\$3,325.00	\$1.90 /watt		
Income Approach Method Energy Value DCF							
Solar Resource		O & M Expense		Utility Rate			
System Size Watts: 1,750		Inverter Size Watts: 1,500		NREL Utility Co: Potomac Electric Power Co			
Module Warranty Yrs: 25		Inverter Warranty Yrs: 15		NREL Utility Rate: 10.98 ¢/kWh			
System Age Yrs: 0		Inverter Age Yrs: 0		User Provided Utility Rate: - ¢/kWh			
Remaining Yrs: 25		Inverter Replaced: No		Utility Rate Used: 10.98 ¢/kWh			
Derate Factor: 0.77		Inverter Replacement Cycle Yrs: 15		EIA Escalation Rate: 3.90% CAGR			
Degradation Rate: 0.50%		Inverter Replacement Cost		User Provided Esc Rate: - % CAGR			
Array Tilt: 26.6 °		Survey Data: 75 ¢/W		Escalation Rate Used: 3.90% CAGR			
Array Azimuth: 90 °		User Provided: - ¢/W		Comments:			
Annual kWh Est: 1,683		Replacement Cost Used: 75 ¢/W		Incentives offset depreciation except for less than ideal orientation requiring high rate. Fed. Tax Credits not included in incentives.			
		O & M Exp (future): \$1,312.50					
		O & M Exp (discounted): \$649.65					
Cost of Capital WACC Used + Risk Premium = Discount Rate → Estimated Energy Value / Income Approach							
Fannie Mae Date: September 14, 2015		200 Basis Points		5.55%		\$2,964.61	
Fannie Mae Rate: 30 Yr 90 day 3.55%		125 Basis Points		4.80%		\$3,262.08	
User Provided Interest Rate: - %		50 Basis Points		4.05%		\$3,597.69	
Estimate of Accumulated Energy Production / Income Approach							
Year	Annual kWh	Low Estimated Value		Avg Estimated Value		High Estimated Value	
		Annual Value	Accumulated Value	Annual Value	Accumulated Value	Annual Value	Accumulated Value
1	1,675	183.87	183.87	183.87	183.87	183.87	183.87
2	1,666	180.09	363.96	181.37	365.24	182.68	366.55
3	1,658	176.38	540.33	178.91	544.15	181.50	548.05
4	1,649	172.74	713.07	176.47	720.62	180.32	728.36
5	1,641	169.17	882.24	174.06	894.69	179.14	907.50
6	1,633	165.67	1,047.91	171.68	1,066.37	177.96	1,085.46
7	1,624	162.24	1,210.15	169.33	1,235.70	176.79	1,262.25
8	1,616	158.88	1,369.02	167.01	1,402.71	175.62	1,437.87
9	1,607	155.58	1,524.60	164.71	1,567.42	174.45	1,612.32
10	1,599	152.34	1,676.94	162.44	1,729.87	173.29	1,785.61
11	1,590	149.17	1,826.12	160.20	1,890.06	172.13	1,957.74
12	1,582	146.06	1,972.18	157.98	2,048.05	170.97	2,128.71
13	1,574	143.02	2,115.20	155.79	2,203.84	169.82	2,298.53
14	1,565	140.03	2,255.23	153.63	2,357.47	168.66	2,467.19
15	1,557	137.10	2,392.32	151.49	2,508.96	167.52	2,634.71
16	1,548	134.23	2,526.55	149.38	2,658.34	166.37	2,801.08
17	1,540	131.41	2,657.96	147.29	2,805.63	165.23	2,966.31
18	1,532	128.65	2,786.61	145.23	2,950.86	164.09	3,129.40
19	1,523	125.94	2,912.55	143.19	3,094.05	162.95	3,290.35
20	1,515	123.29	3,035.84	141.18	3,235.23	161.82	3,448.17
21	1,506	120.69	3,156.53	139.19	3,374.42	160.69	3,602.86
22	1,498	118.14	3,274.67	137.22	3,511.64	159.56	3,754.42
23	1,489	115.64	3,390.31	135.28	3,646.92	158.43	3,902.85
24	1,481	113.18	3,503.49	133.36	3,780.28	157.31	4,048.16
25	1,473	110.78	3,614.27	131.46	3,911.74	156.19	4,190.35
26	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-
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Figure 9: Array

		Beta Version 0.8.1	File #:	Appraiser Indicated Value:	\$1,425.00	\$1.90 /watt	
09/14/15 4:59:09 PM		NA		Report Prepared By:	Sandra Adomatis		
Subject Property Data							
Address: [REDACTED]							
City:	D.C.	State:	DC	Zip Code:	20012		
Property Type:	Residential	PV Project Type:	Existing	PV Ownership:	Owned		
Cost Approach Method Physical Age / Life Depreciated Cost							
Source:	User 8-1-15	DC	Gross Replacement Cost New:	\$2,475.00	\$3.30 /watt		
Life:	25		Straight Line Depreciation:	\$0.00	\$0.00 /watt/yr		
Age:	0		Accumulated SL Depreciation:	\$0.00	\$0.00 /watt		
Additional Depreciation:			Other Depreciation - All forms of loss	\$1,050.00	\$1.40 /watt		
Additional Depreciation:			None	\$	\$ /watt		
Estimated Depreciated Value			Cost Approach:	\$1,425.00	\$1.90 /watt		
Income Approach Method Energy Value DCF							
Solar Resource		O & M Expense		Utility Rate			
System Size Watts:	750.00	Inverter Size Watts:	650.00	NREL Utility Co:	Potomac Electric Power Co		
Module Warranty Yrs:	25	Inverter Warranty Yrs:	15	NREL Utility Rate:	10.98 ¢/kWh		
System Age Yrs:	0	Inverter Age Yrs:	0	User Provided Utility Rate:	- ¢/kWh		
Remaining Yrs:	25	Inverter Replaced:	No	Utility Rate Used:	10.98 ¢/kWh		
Derate Factor:	0.77	Inverter Replacement Cycle Yrs:	15	EIA Escalation Rate:	3.90% CAGR		
Degradation Rate:	0.50%	Inverter Replacement Cost		User Provided Esc Rate:	- % CAGR		
Array Tilt:	26.6 °	Survey Data:	75 ¢/W	Escalation Rate Used:	3.90% CAGR		
Array Azimuth:	270 °	User Provided:	- ¢/W	Comments:			
Annual kWh Est:	722.00	Replacement Cost Used:	75 ¢/W	Incentives offset partial depreciation but higher rate is attributed to less than ideal orientation. Fed. Tax Credits are not included.			
		O & M Exp (future):	\$562.50				
		O & M Exp (discounted):	\$278.42				
Cost of Capital							
Fannie Mae Date: September 14, 2015		WACC Used	+ Risk Premium	= Discount Rate	Estimated Energy Value / Income Approach		
Fannie Mae Rate: 30 Yr 90 day 3.55%		3.55%	125 Basis Points	4.80%	\$1,272.08	\$1.70 /watt	
User Provided Interest Rate: - %		- %	50 Basis Points	4.05%	\$1,399.69	\$1.87 /watt	
					\$1,543.67	\$2.06 /watt	
Estimate of Accumulated Energy Production / Income Approach							
		Low Estimated Value		Avg Estimated Value		High Estimated Value	
Year	Annual kWh	Annual Value	Accumulated Value	Annual Value	Accumulated Value	Annual Value	Accumulated Value
1	718	78.88	78.88	78.88	78.88	78.88	78.88
2	715	77.26	156.14	77.81	156.69	78.37	157.25
3	711	75.66	231.80	76.75	233.44	77.86	235.11
4	708	74.10	305.90	75.71	309.14	77.35	312.46
5	704	72.57	378.48	74.67	383.82	76.85	389.31
6	700	71.07	449.55	73.85	457.47	76.34	465.66
7	697	69.60	519.15	72.84	530.11	75.84	541.50
8	693	68.16	587.30	71.65	601.76	75.34	616.84
9	690	66.74	654.05	70.86	672.42	74.84	691.68
10	686	65.36	719.40	69.89	742.11	74.34	766.02
11	682	63.99	783.40	68.72	810.83	73.84	839.86
12	679	62.66	846.06	67.77	878.60	73.35	913.21
13	675	61.35	907.41	66.83	945.44	72.85	986.06
14	671	60.07	967.48	65.91	1,011.35	72.36	1,058.42
15	668	58.81	1,026.30	64.99	1,076.33	71.86	1,130.28
16	664	57.58	1,083.88	64.08	1,140.41	71.37	1,201.65
17	661	56.37	1,140.25	63.19	1,203.60	70.88	1,272.53
18	657	55.19	1,195.44	62.30	1,265.90	70.39	1,342.92
19	653	54.03	1,249.47	61.43	1,327.33	69.91	1,412.83
20	650	52.89	1,302.36	60.56	1,387.89	69.42	1,482.25
21	646	51.77	1,354.13	59.71	1,447.60	68.93	1,551.18
22	643	50.68	1,404.81	58.87	1,506.47	68.45	1,619.63
23	639	49.61	1,454.42	58.03	1,564.50	67.97	1,687.60
24	635	48.56	1,502.98	57.21	1,621.71	67.49	1,755.09
25	632	47.53	1,550.51	56.40	1,678.11	67.01	1,822.10
26	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-

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This property has three arrays each with a different orientation.
 Since the orientation can materially affect the energy produced, it is

necessary to develop the income approach separately for each array and then combine the value indications to calculate the total value of the solar PV at this location. The MLS listing's description of this HPH sale merely cited the total size of the system at 5kW; therefore, the size of each individual array first had to be determined. Aerial mapping combined with a local builder's counting of panels and direction, provided sufficient information to complete the PV Value calculation.

This type of information-gathering challenge is typical around the country due to the limited descriptive and quantitative data provided in the MLS or by the homeowner. In this specific case, because this system is fairly new it was not identified on the Washington, D.C. mapping website <https://www.mapdwel.com/en/dc>. Further, as noted above, the MLS description did not provide full details of the solar PV array.

The same assumptions used in pair 1 were applied here regarding the inputs for the discounted cash flow using PV Value, which determined the following values for each array.

- Array 1: Estimated 2500 Watts; \$2.18-\$2.63 per Watt
- Array 2: Estimated 1750 Watts; \$1.69-\$2.06 per Watt
- Array 3: Estimated 750 Watts; \$1.70-\$2.06 per Watt

Based on these outputs, the estimated premium range for the solar PV system using the income approach is \$9,705–\$11,719.

Cost Approach for Solar PV System

Array 1 has the ideal orientation of 180 degrees and its depreciation is valued at \$1 per watt. Arrays 2 and 3 have inferior orientations and so their depreciation is valued at \$1.40 per watt to account for the loss in energy production based on orientation. Comparing the indicated value per watt of Array 1, which has ideal orientation, to the value per watt for Arrays 2 and 3 supports the additional depreciation of \$0.40 per watt charged for the latter two arrays.

- Array 1: Estimated 2500 Watts; \$2.30 per Watt
- Array 2: Estimated 1750 Watts; \$1.90 per Watt
- Array 3: Estimated 750 Watts; \$1.90 per Watt

Multiplying each array's power output by their respective contributory value per watt yields each array's total individual value. Summing the three individual values results in a total value of \$10,500 for the solar PV system using the cost approach.

Green Premium Excluding the Solar PV System

SOLAR RENEWABLE ENERGY CREDIT (SREC)

“Under D.C. law, a solar renewable energy credit (SREC), is equivalent to one megawatt-hour (MWh) of electricity derived from an eligible solar resource. Electricity suppliers must purchase SRECs in order to meet their compliance obligations under the law, or pay a Solar Alternative Compliance Payment (SACP) for any shortfalls in SREC purchases. Under this system, SRECs represent a potentially significant source of revenue for owners of qualifying solar facilities with a value determined by demand in the trading market. In D.C., net metering customers retain ownership of SRECs (or RECs) unless they agree to transfer them. A generator remains eligible to generate SRECs for as long as the facility remains certified as an eligible generator. SRECs have a three-year lifetime from the date they are created. In other words, an SREC may generally be used (i.e., retired) for compliance by an obligated electricity supplier for up to three years after the date it is created.”

Source: <http://programs.dsireusa.org/system/program/detail/5686>

The 5kW solar PV system is valued at \$10,500 based on the cost and income approaches to value. Both approaches support the value to be \$10, 500. The average green premium for this HPH is \$41,150 and deducting the indicated solar PV value results in a green feature premium, excluding solar PV, of \$30,650.

5.1.4 Paired Sale 4

Table 12: Paired Sale 4

Paired Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area (SF)	SPP	PRE	Age
Paired Sale 4			LEED Certified						
P-4	4/10/15	14	\$469,000			778			9
S-1	12/16/14	60	\$474,000	\$470,000	0.80%	747	-\$1,000	-0.21%	10
S-2	9/11/14	7	\$456,000	\$455,000	2.00%	773	\$14,000	2.99%	9
S-3	3/15/15	4	\$480,000	\$471,000	4.40%	744	-\$2,000	-0.43%	11
S-4	12/7/14	24	\$475,000	\$467,250	10.20%	717	\$1,750	0.37%	9
Pair 4 - Premium Results									
Subject - HPH Sale	14		\$469,000			778			9
Mean		24	\$471,250	\$465,813	4.35%	745	\$3,188	0.68 %	10

Gross Adj.: Sum of all adjustments regardless of direction of adjustment

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: These pairings provide the lowest green premiums in this study. Pairing the HPH sale P4 with its S1 and S3 comparables results in a slightly negative premium, indicating an inconclusive result. The HPH sales price compared to the S4 sales price results in a less than 1 percent premium, which is also an inconclusive result. However, pairing the HPH sales price with S2 supports a 2.99 percent, or \$14,000, premium, a number that falls within the range of other results in this study. These pairs strongly indicate the need to assess a number of pairings to form a solid conclusion of value contribution for any feature.

[USGBC](#) verified the HPH as LEED certified, receiving 29 points in April 2007. The MLS listing gives little information on the LEED certification, which in 2007 required fewer points to attain. The MLS data only identifies the unit as an “award-winning LEED building.” The relatively low level of certification granted during an earlier version of LEED might explain, at least in part, the lack of a sales price premium. The HPH sold at full price in only 14 days, and the green features were not listed.

5.1.5 Paired Sale 5

Table 13: Paired Sale 5

Paired Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area (SF)	SPP	PRE	Age
Paired Sale 5			LEED Silver-Solar PV for Building-Common Element						
P-5	5/20/14	5	\$661,500			1,090			104
S-1	3/2/14	52	\$675,000	\$644,500	15.20%	1,521	\$17,000	2.57%	110
S-2	5/10/14	16	\$547,000	\$642,000	24.30%	920	\$19,500	2.95%	92
S-3	12/11/13	7	\$663,650	\$645,150	11.80%	1,300	\$16,350	2.47%	83
S-4	11/1/13	9	\$599,000	\$641,250	10.40%	970	\$20,500	3.10%	88
Pair 5 - Premium Results									
Subject - HPH Sale		5	\$661,500			1,090			104
Mean		21	\$621,163	\$643,163	15.43%	1,178	\$18,338	2.77%	93.25

Gross Adj.: Sum of all adjustments regardless of direction of adjustment
SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)
PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: [USGBC](#) verified HPH sale P5 as LEED Silver certified, receiving 65 points in March 2012. The HPH sale included a 4kW solar PV system that provides electricity for the heating system units in the building, but not specifically for this HPH unit. However, the MLS listing provides limited information about the green features. The listing did not mention the existence of solar PV, which should result in lower common area maintenance fees due to reduced electric costs.

The premiums in these pairings support a mean of 2.77 percent of the sales price, or \$18,338. The premium range is very tight for all four pairs indicating strong support for the conclusion.

5.1.6 Paired Sale 6

Table 14: Paired Sale 6

Paired Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area (SF)	SPP	PRE	Age
Paired Sale 6			LEED Platinum						
P-6	12/29/13	20	\$317,000			852			97
S-1	10/23/13	5	\$307,000	\$305,860	3.60%	841	\$11,140	3.51%	108
S-2	11/27/13	0	\$295,000	\$300,000	13.90%	907	\$17,000	5.36%	84
S-3	12/2/13	0	\$317,500	\$311,500	14.50%	870	\$5,500	1.74%	90
S-4	12/7/13	5	\$340,000	\$306,000	20%	1,138	\$11,000	3.47%	90
Pair 6 - Premium Results									
Subject - HPH Sale	20		\$317,000			852			97
Mean	2.5		\$314,875	\$305,840	13%	939	\$11,160	3.52%	93

Gross Adj.: Sum of all adjustments regardless of direction of adjustment

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: [USGBC](#) verified the HPH as LEED Platinum certified, receiving 100 points in April 2011. The four non-HPH sales compared to this LEED Platinum unit support a mean green premium of 3.52 percent, or \$11,160. The HPH and non-HPH sales were boutique multi-unit buildings competing for similar buyers.

Three pairs have gross adjustments exceeding 10 percent but less than 25 percent, a maximum adjustment many appraisers find acceptable and some lenders use. The strength of these pairs is exhibited by the tight premium range between 1.74-5.36 percent. The strongest pairing is S1, which only has a 3.6 percent gross adjustment and is supportive of the mean price premium.

5.1.7 Paired Sale 7

Table 15: Paired Sale 7

Paired Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area (SF)	SPP	PRE	Age
Paired Sale 7			LEED Silver						
P-7	5/16/15	4	\$599,000			869			2
S-1	4/13/15	20	\$465,000	\$545,000	17.20%	872	\$54,000	9.02%	12
S-2	2/25/15	34	\$475,000	\$557,500	24.10%	752	\$41,500	6.93%	11
S-3	1/21/15	0	\$522,600	\$554,600	11.10%	891	\$44,400	7.41%	7
S-4	1/8/15	56	\$500,000	\$554,000	17.60%	916	\$45,000	7.51%	9
Pair 7 - Premium Results									
Subject - HPH Sale		4	\$599,000			869			2
Mean		27.5	\$490,650	\$552,775	17.50%	858	\$46,225	7.72%	9.75

Gross Adj.: Sum of all adjustments regardless of direction of adjustment

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: The four pairings support a mean premium as a percent of sales price of 7.72 percent, or \$46,225. This mean premium is tightly bracketed by all four pairings. Further research of the subject HPH sale revealed that this building is located in a large mixed-use development on over 10 acres of land with a LEED Neighborhood Development certification according to the development's website. The amenities include an extensive roof park with a pool, outdoor kitchen and dining area. This development also has some high-priced units that usually affect unit prices throughout the development. Prices may also be influenced by the presence of high-profile buyers in this development. The high green premium, therefore, may be a reflection of extensive amenities, high-profile owners, and green features.

5.1.8 Paired Sale 8

Table 16: Paired Sale 8

Paired-Sale #	Contract Date	DOM	Sold Price	Adj. Sale Price	Gross Adj.	Living Area	SPP	PRE	Age
Paired Sale 8			Built to LEED						
P-8	10/15/13	9	\$817,000			1,441			99
S-1	6/11/13	4	\$730,000	\$793,500	8.70%	1,294	\$23,500	2.88%	103
S-2	2/12/13	8	\$811,000	\$800,000	12.20%	1,219	\$17,000	2.08%	115
S-3	6/16/13	0	\$837,000	\$805,000	5%	1,593	\$12,000	1.47%	4
S-4	4/10/13	19	\$816,000	\$806,000	11.00%	1,474	\$11,000	1.35%	5
S-5	9/19/13	49	\$865,000	\$804,000	8.20%	1,409	\$13,000	1.59%	88
Pair 8 - Premium Results									
Subject - HPH Sale	9		\$817,000			1,441			99
Mean	16		\$811,800	\$801,700	9.02%	1,398	\$15,300	1.87%	63

Gross Adj.: Sum of all adjustments regardless of direction of adjustment

SPP: Sales Price Premium (Green Sale Price - Adjusted Non Green Sale Price)

PRE: Premium as percent of sale price (Premium/Green Sale Price)

Summary: The HPH and non-HPH comparables are located in two- to 12-unit boutique-style condominium buildings. Unfortunately, the phrase “built to LEED” is not defined specifically by the MLS. The HPH does have some green features but it is unclear whether the property was actually built to a specific LEED standard. The five pairs support a tight green premium range between 1.35–2.88 percent and a mean premium of 1.87 percent, or \$15,300. The gross adjustment to the pairings is low and indicates a high degree of comparability.

6. Key Findings

- The large majority of the paired sales support the conclusion that HPHs command a sales price premium. Of the 32 pairs, 29 support a green premium and three are inconclusive with premiums less than 0.5 percent, a number too small to be meaningful in this price range for housing.
- The mean green premium as a percentage of sales price is 3.46 percent and the median premium is 2.91 percent, with 19 pairs supporting 2–5 percent premiums.
- Of the eight HPH sales paired, six were structures ranging from 92-104 years old with retrofits occurring in the last five years.
- Two of the HPH sales were newer structures (less than five years old) that have green features but no certification.

- The total dataset of 64 homes had sales prices ranging from \$265,000-\$1,415,000. However, the 32 pairs had a much tighter range of \$317,000-\$865,000.
- Days on the market results are inconclusive and may be a result of a very active housing market with limited competition.²¹ Alternatively, it may be that the HPHs command a higher price and take slightly longer to receive that price. On average, the HPHs spent 20 days on the market, while the similar non-HPHs experienced a mean of 16 days on the market. The median days on the market were 12 for the HPH sales and seven for the non-HPH sales. Overall, the difference is insignificant.
- The paired sales analysis is within the range of cost estimates provided by the McGraw Hill Smart Market Report as shown in the following table. The average premium of 3.46 percent is less than the retrofit cost of new green features and passes the test of reasonableness.

Table 17: Green Premium Comparison: Cost Approach vs. Paired Sales Analysis

Comparison of Cost Approach versus Paired Sales Analysis		
McGraw Hill Smart Market Report	New Construction 5.7% to 8%	Retrofit 7.5% to 9.5%
Paired Sales Analysis	None were new construction Newest structures were less than 5 years old.	1.35% to 9.02% Excludes 3 indications at the extreme low end under 0.5%
Income Approach	Could only be applied to Pairs 1 and 3's Solar PV system. Insufficient data are available to estimate the value of energy features using this approach.	

7. Discussion

This study renders strong support for HPHs selling at a premium in Washington, D.C. Competent appraisers can cite this study's results as secondary support for their reconciled conclusions. As previously noted, the study results should only be used as supporting evidence for appraisals in similar market areas during a similar time period, specifically effective date of sale,²² that reflect similar economic conditions and green features.

The eight HPH sales identified in this report did not have energy reports, green certifications, or full details of their green features listed in the MLS. The MLS has a utilities section that asks for the

²¹ The D.C. market has a limited number of units on the market and no land to build new green homes.

²² Effective date of value is the date the property is appraised. Market trends fluctuate just as stocks do and require appraisers to use the appropriate data to reflect market conditions and trends at the time of sale.

following details (Table 18) that would be extremely helpful in the appraisal process and in assisting buyers to make knowledgeable decisions. It is also important to know the number of occupants and if the unit is occupied year round, two factors that can materially affect the utility costs.

Table 18: MRIS Utilities Section

MRIS Utilities Section		
Electric 12 Months/Average Cost	Gas 12 Months/Average Cost	Water 12 Months/Average Cost

The MLS data presented in this report had none of these utility cost figures included to allow utility cost comparisons. An income approach can only be developed when data are available to make actual comparisons of quantifiable costs.

Even though the secondary mortgage market does not require it,²³ underwriters or lending guidelines often use the “no sale no value” concept when reviewing appraisal reports. To this end, some underwriters require appraisers to use a HPH sale in the sales comparison approach, or they will not accept premiums for the green features.²⁴

USPAP requires appraisers to support adjustments using applicable appraisal methodology; not making an adjustment implies a zero adjustment. USPAP implies that support for zero adjustments is necessary just as it is for non-zero adjustments. This study provides good secondary support for a non-zero HPH adjustment in this study area.

Lenders, underwriters, and users of appraisal services must now ask themselves if their appraisals are in compliance with USPAP. Have the appraisals of properties with green features in Washington, D.C. been accurately reflecting green premiums? How can we improve the marketing, lending, and appraising process? The following recommendations are made based on the challenges presented in this study area.

8. Recommendations

This section discusses the hindrances encountered during this study, along with the steps needed to improve the valuation process.

Challenge: The MLS listing of each HPH sale used in this analysis rarely included more than a comment in the narrative description

²³ Secondary mortgage market parties include Fannie Mae, Freddie Mac, FHA, and VA.

²⁴ A premium is also known as an adjustment in the sales comparison grid of an appraisal.

indicating the property has a green certification. Verifiable documentation of homes or units with green third-party certifications and solar PV systems must be made available for the real estate market.

The term most often used to identify the listing as a property with green features is “LEED.” The label is meaningful to individuals with knowledge of sustainable programs but may not be a common term to all buyers. Simply stating a property has a LEED certification without explaining the benefits and attaching the certification and green scoresheet is not sufficiently meaningful to a large portion of the market.

Steps forward to resolve challenge:

- Include the green certification as an attachment in the MLS;
- Label the electrical box onsite showing the HERS rating, green certification rating, and date rated;
- Provide sufficient green details in the MLS searchable fields to provide good marketing techniques and maximize the sales price for these features;
- Recognize that improper marketing of HPH listings can be a liability for agents.

Challenge: Properties listed with a solar PV system rarely included the system’s size, age, or energy produced in the MLS. How is a buyer to understand the benefit of this costly system? Even the public property record does not include the size, age, or type of solar PV system because most residential systems are not taxable if it is an owned system. If the system is leased, it is taxed as personal property and cannot be included in market value.

Steps forward to resolve challenge:

- Label the electrical box with the same inputs found on the solar page of the [AI Residential Green and Energy Efficient Addendum](#),²⁵ making a permanent record onsite;
- Include the description of the solar PV system in the recorded property record, noting the size, age, location, and type of system on the public record card to allow verification of data;
- Develop a public solar PV database that could be accessed through sites as such PV Value²⁶ that would allow the user to verify the solar PV system details.

²⁵ <http://www.appraisalinstitute.org/assets/1/7/Interactive820.04-ResidentialGreenandEnergyEfficientAddendum.pdf>.

²⁶ <https://www.pvvalue.com/>.

Additional steps forward to resolve challenges facing HPH valuation and sales:

- Real estate sales agents and appraisal professionals need education to identify green features, understand their benefits, and uncover resources available to market and value them.
- Real estate sales agents need education on the use and importance of completing the [AI Residential Green and Energy Efficient Addendum](#) upon listing a house with green features. The Addendum should be placed in the MLS as an attachment for potential buyers, other sales agents, and appraisers to use in understanding or valuing HPHs. It is difficult for appraisers to compare sales accurately if the details of the green features are not known. Properties varying in the number of green features or shade of green require analysis. It is a potential liability for sales agents that do not understand the benefits of green features to attempt marketing HPHs. If a property is not marketed appropriately, it may not sell at its potential price. The definition of market value assumes a competitive and open market under all conditions requisite to a fair sale.
- Realtors® have a competency requirement in their Code of Professional Ethics – Article 11: “Realtors shall not undertake to provide specialized professional services concerning a type of property or service that is outside their field of competence unless they engage the assistance of one who is competent on such types of property or service, or unless the facts are fully disclosed to the client. Any persons engaged to provide such assistance shall be so identified to the client and their contribution to the assignment should be set forth.”²⁷
- Real estate appraisers are required to have competency prior to accepting the assignment according to FHA, Fannie Mae, and Freddie Mac guidelines. Competency suggests the appraiser has knowledge of the property type and geographical area, as well as appraisal knowledge to allow them to produce a credible report. Lenders in many cases are in noncompliance with the guidelines that require they engage competent appraisers. Even when a lender uses an appraisal management company to order the appraisal, the lender is still held responsible for the appraiser selection according to the secondary mortgage market guidelines.
- Homeowners, builders and real estate agents should choose an appropriate lender. Knowing the lender’s process for selecting

²⁷ National Association of Realtors®, [“Code of Ethics and Standards of Practice of the National Association of Realtors®,”](#) effective January 1, 2015.

appraisers before applying for a mortgage on a HPH can save a borrower from an unpleasant and costly experience.

- State regulatory agencies (state appraiser boards) must have sufficient knowledge of green valuation to investigate complaints on appraisal reports submitted by the public and rule appropriately.

Appendix: Resources for Valuing and Marketing Residential Properties with Green Features

- The **Appraiser's Guide to Identifying Green Features in Homes**, Kathy Price-Robinson (The Appraisers Research Foundation, 2012). Kathy Price-Robinson wrote this guide in 2012 to help appraisers identify the most common green features in a home. The Appraiser's Research Foundation funded the guide that was published in 2012.
- **[Database of State Incentives for Renewables & Efficiency \(DSIRE, dsireusa.org\)](#)**. Operated by the N.C. Clean Energy Technology Center at N.C. State University and funded by the U.S. Department of Energy, this website and associated database of incentive information houses the most up-to-date information on incentives associated with green features. It provides information on federal, state, local, and utility incentives. This website is useful to all types of properties both existing and new construction. Incentives and rebates are listed that can be most helpful in replacing items in existing homes or offsetting costs of new construction. This website also has a solar section that address rebates, incentives, and solar legislation.
- **ENERGY STAR New Homes Partner Locator** (http://www.energystar.gov/index.cfm?fuseaction=NEW_HOMES_PARTNERS). On this site's [New Homes Partners in District of Columbia page](#), ENERGY STAR-certified homes in the [District of Columbia](#) are totaled by year and since the program began in 1995.
- **Fannie Mae Selling Guide** (Fannie Mae, December 2014). The most recent [selling guide](#) by Fannie Mae was released on December 16, 2014, and can be accessed online at <https://www.fanniemae.com/content/guide/selling/index.html>.
- **[Greening the MLS: Bringing High-Performance Homes to Light in the District of Columbia](#)**. Leonard Kolstad (Institute for Market Transformation, April 2015). This report published by the Institute for Market Transformation, Elevate Energy, and Metropolitan Regional Information Systems (MRIS) examines the market supply and demand for high-performance homes in Washington, D.C. Funded by the District Department of the Environment. It can be accessed at IMT.org/resources.
- **Home Energy Score, U.S. Department of Energy Office of Energy Efficiency & Renewable Energy** (<http://energy.gov/eere/buildings/home-energy-score>). A

home energy score is a similar to a vehicle's miles-per-gallon rating. It helps homeowners and buyers understand how much energy a home is expected to use and provides suggestions for improving its energy efficiency. This [score](#) is for existing homes only, and it should not be confused with a HERS Index.

- **The Institute for Market Transformation (IMT.org).** IMT is a Washington, D.C.-based nonprofit focused on energy efficiency in buildings that offers a number of resources to assist appraisers and agents in commercial and residential high performance properties.
- **ICC 700 National Green Building Standard (NGBS). (Home Innovation Research Labs, www.homeinnovation.com).** The [NGBS](#) provides practices for the design and construction of all types of green residential buildings, renovations, and land developments. It is the only residential green building rating system approved by ANSI as an American National Standard. The Home Innovation Research Labs website has some good [resources](#) regarding cost comparison of ratings systems on different types of properties. The website has a [downloadable spreadsheet](#) of the addresses and certified status of properties by state. As of the date of this study, there were no NGBS certified buildings in D.C., but there are some multifamily projects in the process of being certified.
- **MapDwell Solar PV Mapping Application. (www.mapdwell.com).** MapDwell contains a searchable map of installed solar PV systems in Washington, D.C. An appraiser can use this information to understand solar adoption rates and potential comparable properties with solar PV systems. Other available regions include Boston; Boulder, Colo.; Cambridge, Mass.; New York City; San Francisco; Washington County, Ore.; and Wellfleet, Mass.
- **[PV Value \(www.pvvalue.com\)](http://www.pvvalue.com)** [PV Value](#)® is a free discounted cash flow and cost approach program that was designed specifically for appraisers' use in valuing solar PV systems as well as other related professionals. The program requires specific inputs based on the solar system and inverter size in watts, age and of system, azimuth and tilt of panels, discount rate, warranty term of the system and inverter(s), current net and gross cost of the system, and verification of utility and utility escalation rate. [PV Value](#)® provides some defaults but allows the user to input custom numbers. It is important that the user understand the discounted cash flow and importance of accuracy of the inputs to arrive at a credible value opinion.

The tool is used in the classroom setting through the Appraisal Institute's [*Residential and Commercial Valuation of Solar*](#). This class provides appraisers, lenders, real estate agents, builders, and energy raters with a better understanding of solar PV systems and how they can be valued.

- **Renewable Energy Ready Home: Solar Photovoltaic Specification, Checklist and Guide** (U.S. [Environmental Protection Agency, May 2011](#)). The Renewable Energy Ready Home specifications were developed by the U.E. Environmental Protection Agency to assist builders in designing and constructing homes with features that assist with the installation of solar energy systems after construction completion. It can be accessed online at https://www1.eere.energy.gov/buildings/residential/pdfs/rerh_pv_guide.pdf.
- **Residential Energy Services Network (RESNET, resnet.us).** This organization adopted the [Mortgage Industry National Home Energy Rating Standards \(HERS\)](#). The HERS Index is a scoring system established by the Residential Energy Services Network in which a home built to the specifications of HERS Reference Home (based on the [2006 International Energy Conservation Code](#)) scores a [HERS Index](#) of 100, while a net zero energy home scores a HERS Index of 0. The lower a home's score, the more energy efficient is in comparison to the HERS Reference Home.
- **Residential Green Valuation Tools.** Sandra K. Adomatis, SRA< LEED Green Associate (Appraisal Institute, 2014) A publication by the Appraisal Institute and authored by Sandra K. Adomatis, co-author of this study, provides valuation guidance for appraisers, builders, real estate agents, home owners, and lenders. It can be accessed online at <http://www.appraisalinstitute.org/residential-green-valuation-tools>.
- **[Single Family Housing Policy Handbook \(HUD Handbook 4000.1\)](#).** The U.S. Department of Housing and Urban Development's most recent Single Family Housing Policy Handbook 4000.1 (FHA) was released June 24, 2015 and will become effective September 14, 2015. It can be accessed online at http://portal.hud.gov/hudportal/HUD?src=/program_offices/ho_using/sfh/handbook_4000-1.
- **Solar Ready Homes.** Documentation is available for builders on what types of planning and construction methods to consider when building a solar ready home. This information can be useful for valuation professionals by pointing out specific

features to look for when valuing the property. Accessible online at

https://www1.eere.energy.gov/buildings/residential/pdfs/rerh_pv_guide.pdf

- **Solar Ready Buildings Planning Guide.** L. Lisell, T. Tetreault, and A. Watson (National Renewable Energy Laboratory, December 2009). Accessible online at <http://www.nrel.gov/docs/fy10osti/46078.pdf>
- **Taking Sustainability Seriously In Washington, D.C.** Jacob Kriss, (U.S. Green Building Council, January 2013). The blog post “[Taking Sustainability Seriously in Washington, D.C.](http://www.usgbc.org/articles/taking-sustainability-seriously-washington-dc)” gives some good details on LEED buildings in the District of Columbia. It can be accessed online at <http://www.usgbc.org/articles/taking-sustainability-seriously-washington-dc>. Projects certified under the LEED for Homes system must meet ENERGY STAR for Homes. Green -certified homes might have an ENERGY STAR rating as well as a third-party green certification, making it very difficult to quantify with accuracy the number of HPHs.
- **USGBC Project Directory** (<http://www.usgbc.org/projects>). An address (or even a partial address) can be entered into the “Search projects” field. After linking to a project, the project scorecard can be downloaded by clicking on the “Download Scorecard” link. The scorecard reviews the points attained in each of the LEED project categories. Note: the project scorecard may not be available for earlier versions of LEED.
- **Zero Energy Ready Home (ZERH).** U.S. Department of Energy Office of Energy Efficiency & Renewable Energy (<http://energy.gov/eere/buildings/zero-energy-ready-home>). A [DOE Zero Energy Ready Home](http://energy.gov/eere/buildings/zero-energy-ready-home) is a high-performance home which is so energy efficient that a renewable energy system can offset all or most of its annual energy consumption. Check out the resources on this site that provide webinars, fact sheets, and building science details that can be extremely helpful in understanding high-performance buildings.

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Sandra's valuation and green building knowledge is sought by many for consulting in the area of valuing energy efficiency and green building technology. Consulting clients include builders, governmental agencies, utility companies, and energy organizations. She is a national speaker on the valuation of green features at events such as GreenBuild, International Builders Show (IBS), Energy and Environmental Building Alliance (EEBA), Affordable Comfort, Inc. (ACI), The White House Conference Center, Residential Energy System Network (RESNET), National Association of Realtors, and Appraisal Institute Conferences.

As a nationally recognized expert, news columnists often quote Sandra on the valuation of high-performance buildings. The *New York Times* interviewed her regarding her involvement in the Lawrence Berkeley National Laboratory study, "Selling into the Sun: Price Premium Analysis of a Multi-State Dataset of Solar Homes."

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Donald Boucher, SRA, has extensive knowledge of the Washington, D.C. market and provided the research and pairing of data presented in this study. He is the President of Boucher and Boucher, Inc. in the Washington, D.C. area.

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Since the early 1990s, Don has focused his valuation work primarily in the residential sector. He currently provides residential valuation services to a variety of clients including attorneys, lenders, relocation companies, and other private clients. He has testified as an expert witness in local and federal courts relating to various litigation matters including marriage dissolution, partnership disputes and bankruptcies.

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About Adomatis Appraisal Service

With more than 25 years of experience in real estate appraising, Adomatis Appraisal Service provides expertise in residential, vacant

land, multifamily, and commercial properties. Its clients include attorneys, lenders, real estate agents, property owners, and government agencies. Founder Sandra Adomatis, SRA, LEED Green Associate, is an instructor for residential seminars and courses through the Appraisal Institute, a national speaker on the topic of green and energy-efficient house values, a past president of the West Coast Florida Chapter of the Appraisal Institute, and a published author. For more information, visit adomatisappraisalservice.com.

About the Department of Energy and Environment

The Department of Energy and Environment is the leading local authority on all environmental and energy-related matters impacting the District of Columbia. The agency improves the quality of life for the residents and natural inhabitants of the nation's capital by protecting and restoring the environment, conserving our natural resources, mitigating pollution, reducing energy consumption, increasing renewable energy generation and clean power usage, and educating the public on ways to secure a sustainable future. Learn more at doee.dc.gov.

About the Institute for Market Transformation (IMT)

The Institute for Market Transformation (IMT) is a Washington, D.C.-based nonprofit organization promoting energy efficiency, green building, and environmental protection in the United States and abroad. IMT seeks to ignite greater investment energy efficiency in the building sector through activities including technical and market research, policy and program development and deployment, and promotion of best practices and knowledge exchange. IMT's efforts lead to important new policy outcomes, widespread changes in practice, and ultimately, lasting market shifts toward greater energy efficiency, with substantial benefits for the economy and the environment. For more information, visit imt.org.

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