Integration of a Green Metric into Appraisal Methodology

Subtopic: Setting International Valuation Standards

Tracy Reiss, Real Estate Appraiser, MPA and LEED AP
The William Fall Group

129 Bennington Road, Akron, Ohio 44313
Telephone: 330.289.0041
Email: treiss@williamfallgroup.com

Table of Contents

1. Introduction.

Changing economic and environmental trends are reshaping the global financial system. This manuscript highlights trends related to sustainability and examines the central role of commercial real estate therein. Justification for a green metric is provided via a conceptual framework embedded in both economic and appraisal theories. Recommendations regarding pertinent components of a green metric are introduced. Hypothetical application of the metric to highly performing properties, damaged properties, and future international economies wherein carbon is priced concludes the manuscript.

2. Sustainability, Metrics, and Assumptions.

Section 2 explores sustainability and commercial real estate. Highlights from recent studies are provided. The standardizing role of a metric as a means through which to encourage more efficient markets is explored.

2.1 Sustainability. Sustainability has many definitions. For our purposes, a simple definition will suffice. Sustainability is “improving the quality of human life while living within the carrying capacity of supporting ecosystems” (Union). Sustainability is holistic in nature and integrates a long-term approach premised in triple bottom line benefits that are economic, environmental, and equity-based in nature. Typical sustainability considerations include, but are not limited to: renewable resources, recycled products, energy efficiency, and conservation measures. Sustainable building (aka green building) integrates environmental considerations into overall design, construction, and maintenance. Interest in green properties has grown exponentially in recent years, with concerns regarding high energy costs providing an additional boost. The simultaneous emergence of global economic constraints within an age of growing environmental awareness, has resulted in circumstances wherein sustainability considerations have increasing relevance.

Buildings form one of the major catalysts for environmental degradation on the planet. Energy utilized by buildings is a tremendous drain on the earth’s natural resources,

which in turn has a huge impact on our economy (Simmons, Introduction, webinar). While overall statistics regarding energy usage and waste generation vary, most all tend to be staggering in their impact. In 1995, a groundbreaking summary delineating the impacts of buildings on the environment was published by the World Watch Institute. In it, authors noted that buildings consume 40% of world energy production, 17% of all water pumped out of natural water flows, and 25% of all virgin wood harvested (Lenssen). According to recent data provided by the Energy Information Administration (EIA) on a global level, buildings (residential, commercial, and industrial) collectively represent 72% of all end use energy consumption (EIA). The commercial and industrial sectors alone represent 50% of the energy consumed by end use (see 2008 EIA chart at right). Nearly 50% of all greenhouse gas emissions overall are attributed to the commercial and industrial sectors of the economy, either through the burning of carbon-based fuels for heating and manufacturing or through the use of electricity. (Company 1).

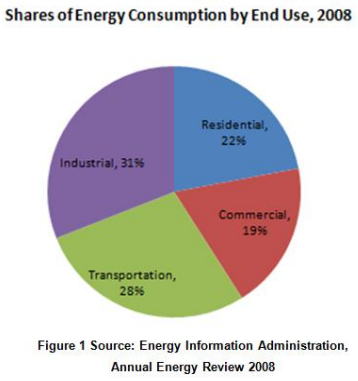


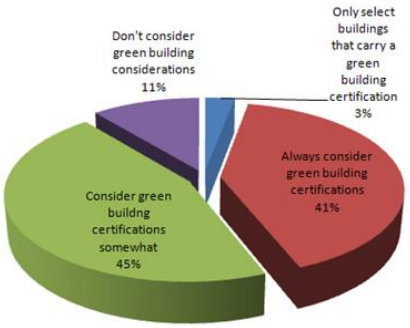
Figure 1 Source: Energy Information Administration, Annual Energy Review 2008

By virtue of its proportionately large share of energy usage, buildings are likely to be affected as sustainability considerations continue to be integrated into the market. It follows that improving the energy efficiency of commercial buildings alone would have a tremendous impact an individual's ability to ensure sustainability and be likely to positively influence value. The more efficiently a building can operate while consuming fewer resources, the more sustainable, and therefore valuable, that real estate is likely to be long-term.

2.2 Impacts of Sustainable Attributes on Value. Given increased interest in green properties, numerous studies have been conducted in attempts to capture value influences attributable to sustainable design features. The data have revealed "that the value of a building can be linked to the building's perceived level of sustainability" (Reed 1). Many of the studies have demonstrated positive influences on value in green properties directly related to factors such as: lower operating costs; longer life spans;

rental premiums; higher relative investment returns; higher occupancy rates; and higher sales prices. Furthermore, as findings from a recent survey conducted by CoreNet Global and Jones Lang LaSalle demonstrate, more respondents are considering sustainability factors (in general) in decisions related to real estate. Specifically, while a stable 89% of respondents continue to consider green building certification, the percentage that "always consider" them rose from 26% to 41%. A new question in 2009 further revealed that 90% of respondents consider energy scores or labels to be important" (LaSalle 3). Volumes of similar data are growing as are consumer expectations in support of the inclusion of green features. Further and detailed analysis of the documented studies in support of sustainable attributes and their positive influence on value is beyond this scope of this paper. However, "it makes sense that sustainable buildings should have more value. They are built better, are better stewards of the environment, consume less energy, and save money on energy costs" (Simmons, An Introduction to Green Homes 119).

Figure 1 Source: Jones Lang LaSalle, CoreNet Global 2009 Survey on Corporate Real Estate and Sustainability



2.3 Metrics. Sustainability attributes are influencing market value. As a result, it is essential that efforts be made to articulate at minimum, and quantify at best, those value influences in appraisal methodology. The question is how to most appropriately, most consistently, most uniformly supplement and/or augment current appraisal methodology in order to take this factor into account. "Standards markets work more effectively if common metrics are agreed upon for key issues…[and are] a pre-requisite for the next stage of development" (EPA 16). While increasingly available sustainability rating tools (ie. Leadership in Energy and Environmental Design [LEED]), green underwriting models and specialized data provide beneficial information to appraisers, a significant void yet remains in terms of the extraction of the influence of green factors on market value. A standardized green metric is recommended to meet this need. Integration of a green metric into basic appraisal methodology will provide the common denominator

necessary to account for sustainable features and articulate relevant impacts upon market value.

2.4 Assumptions. The subject manuscript assumes a US perspective in appraisal methodology and government policy. Commercial real estate is the primary subject. The terms sustainable and green will be utilized interchangeably throughout. While this manuscript does not take a position on global warming, it does at a very basic level assume that the earth's ecosystem is not immune to affect from human influences. Unlimited, uncontrolled, and unmonitored emissions from fossil fuel sources is considered the non-preferred, and unsustainable alternative.

3. Economics, Real Estate and Market Value.

In order to understand the premise behind recommended development of a green metric, it is helpful to examine basic economic theory and fundamental real estate tenets. Underlying assumptions present in both economics (in general) and real estate (specifically) provide the framework upon which to justify integration of a green metric.

3.1 Economics (and the Role of Information). At a very basic level, economics studies how a society makes choices regarding the allocation of its limited resources among alternative uses to satisfy unlimited human wants. Inherent throughout is a recognition of scarcity, and the importance of allocating resources in an efficient manner. Assumptions exist that homogeneous goods are priced appropriately, firms are price takers, all firms have a small share of the market, and supply and demand factors operate so as to ultimately lead to value optimal allocations at society's stable equilibrium point. While the aforementioned presents a high-level overview of a theoretically competitive market in a perfect world, economic theory provides a useful framework within we can better understand the role of appraisers. Specifically, appraisers are active observers of the market system, utilizing available information, to provide an opinion of "the most probable price, as of a specified date…for which the specified property rights should sell after reasonable exposure in a competitive market…with the buyer and seller acting prudently, knowledgeably, and for self-interest, and assuming that neither is under undue duress" (Institute 22).

Information therefore has inherent economic value because it allows individuals to make choices that yield higher expected utility (in economic terms, a measure of relative satisfaction) than they would obtain from choices made in the absence of information. Nobel Laureate economist, Friedrich Hayek, studied the use of Knowledge in Society in 1945 wherein he stated, "*If* we possess all the relevant information, *if* we can start out from a given system of preferences, and *if* we command complete knowledge of available means, the problem which remains is purely one of logic…." (Hayek). Hayek continues…"The economic problem of society is thus not merely a problem of how to allocate "given" resources… It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge which is not given to anyone in its totality" (Hayek).

So it is with the appraisal profession as it applies to the utilization of the growing green information base. The relevant question is how can appraisers secure the best use of our resources in the search of information, to best understand that which is increasingly known by individuals and impacting the market. Specifically, appraisers recognize that green features are impacting the market, however, appraisers do not regularly employ a consistent metric that describes, measures, compares, and attempts to capture value impacts associated with these sustainable features. This void represents a significant knowledge gap. This void represents a deficient valuation methodology. The author of the subject manuscript argues that the lack of integration of a consistent green metric into appraisal methodology contributes to market failures. Market failures lead to lower individual utility levels (measures of relative satisfaction) and "less perfect" resource allocations. Furthermore, market imperfections wreak havoc with the ability of a market to achieve sustainable outcomes over the long-term. As appraisers, if we are to facilitate a "rational" economic order with participants acting "knowledgably", then steps must be taken to improve the quality of the information utilized in appraisal analysis to arrive at the most reliable indicator of values.

3.2. Real Estate (and Emerging Market Transformations). The value of real property reflects and is affected by the interaction of social trends, economic circumstances, government controls and environmental conditions (Institute 43). All four forces are interacting in today's marketplace so as to indicate the rising importance of sustainability considerations in value determination. "The public is becoming increasingly aware of energy efficiency, water and resource conservation, the use of recycled products, and measures to improve indoor air quality" (Simmons, An Introduction to Green Homes 118). Major corporations have adopted conservation and sustainability objectives. Green building is fundamentally altering real estate market dynamics –the nature of product demanded by tenants, constructed by developers, required by governments and favored by capital providers (Fur 59). Governments are increasingly requiring energy efficiency measures. Buildings that are not energy efficient or cannot be feasibly upgraded run the risk of functional obsolescence (Muldavin 87). It naturally follows that given these shifts in market forces, appraisers (as observers and interpreters of the market) would be expected to take appropriate steps to reflect the influence of these specific forces upon value. Failing to acknowledge the role of sustainability in today's market is failing to understand where society is socially, economically, and environmentally in the twenty-first century.

While market transformations indicate the role of sustainability, the articulation of related value impacts is notably lacking as it relates to the sales and cost approaches to value. Regarding the sales approach, many green buildings are public or owner-occupied properties and not built for investment purposes. The properties transfer rarely, and given the subsequent lack of data, determination of value impacts based upon a paired sales analysis is limited. Regarding the cost approach, it is difficult to reliably estimate a base cost that adequately takes into account variations in green features specific to a given improvement. As will be explored later in this paper, the income approach, with its inherent recognition of increased income potential, reduced operating cost, and elements of risk appears uniquely capable of capturing green value influences.

3.3. Value Creation (and Bundles of Rights). Value is defined as "(1) the monetary worth of a property, good, or service to buyers and sellers at a given time, (2) *the present worth of the future benefits that accrue to real property ownership*" (McKinley 20). Ownership in real property can be compared to a bundle of sticks, with each stick representing a separate right/interest in the property. Restrictions on ownership rights may inhibit the flow and benefits, and therefore, lower the property's value. Similarly, a property can only achieve its highest value if it can legally perform its most useful function (Institute 30). Because it is physically immobile, real estate is affected by external influences more strongly than most other economic goods, services, or commodities. Environmental regulations…and other limitations [or expansions in that bundle] can detract or enhance a property's utility and value" (Institute 29). Buildings with sustainable features have the potential to enhance value via generation of a variety of benefits that are monetary, direct, and exclusive.

It is the contents of the bundle of rights attached to the physical property that is the focus of value creation. Given the changes in trends as they relate to greenhouse gas emissions and energy demand, and assuming well-defined property rights, the author asserts (as a non-lawyer) that there is the potential for a "green-*tinted*" bundle of rights to emerge. The green tinted bundle would reflect an updated concept of inherent rights that acknowledges and values measures of sustainability capacity.

For purposes of illustration of the impacts of a green bundle, we will focus briefly upon the carbon sequestrating and energy generating potential of real property. The fee simple interest could be enhanced by a particular **natural real estate's** (in this example, trees in particular) ability to provide services such as the absorption of carbon (assuming a future market that recognizes carbon sequestration credits). Alternatively, the fee simple interest could be enhanced by the **improved real estate's** ability (direct sunlight with solar panels on roof) to provide services such as the production of energy (assuming alternative energy becomes the norm). Under the green bundle concept, benefits and rights inherent to the ownership of real property changes with market

acknowledgement of either a market for carbon or a value in on-site/off-grid energy production. Theoretically, this market acknowledgement could emerge as an augmentation of the delineated partial interest relating to the right to lease an interest and occupy the property or perhaps as its own separate interest reflecting a property's inherent ability to harness energy and/or sequester carbon.

Recognizing and pricing partial interests in land related to environmental goals is not new (Reay 136). For example, partial interests recognizing the environmental benefits of real property in the form of conservation easements have been in place for some time now (Wiebe 36). The potential carbon-related or energy-production-related interests would likely be similar in form and function to conservation easements in terms of the societal benefits to the public, but they would also allow for individualized monetary, direct, and exclusive benefits. Such values could be directly captured in appraisal analysis. Heightened societal consciousness regarding sustainability, combined with potential impacts on the real property bundle as it relates to such forces as energy production and carbon sequestration, reinforce the likelihood of value impacts.

3.4. Summary. As the economic marketplace responds to changing trends, all factors being equal, more efficient markets are possible with better information. Economic, social and environmental trends reflect market prioritization of green features. Integration of a uniformly applied and consistently integrated green metric that attempts to capture these related value influences is necessary and urgent. ***"Continual refinement is essential to the appraisal profession***" (Institute 21). Details regarding the recommended green metric refinement follows.

4. Suggested Green Metric Components

As Robert Roth, Esquire so eloquently asserted in his essay on Measuring Green, "the time for trivializing the state of our environment is behind us...Our stakes have matured". So, too, must our appraisal methodology. Likely green metric components will rely upon performance measures, discounted cash flow (DCF) analysis, and include new property attributes in value consideration.

4.1 Emphasis upon a performance-based approach. Appraisal academics have asserted that "the sustainability arena suffers not from lack of information, but from a lack of the right kind of information" (Cannon 4). Sustainable buildings, by definition, are "high performing" structures that operate more efficiently while consuming fewer resources. Any metric that is designed to account for green features must integrate actual data on the specific energy performance of the subject property.

Under the conventional assumptions, unless otherwise noted, all buildings are generally assumed to perform at typical market levels in terms of such factors as energy efficiencies, operating costs, vacancy levels, and risk. Green buildings with varying degrees of sustainability can represent a continuum of high performance. With each level of sustainable attributes, there are different expectations with regard to such factors as energy efficiencies, operating costs, and overall performance. Because of the differentiating role that anticipated performance of the subject building is expected to play, a metric must be incorporated which takes into account the *actual influence that these factors have on specific value* for a specific property. In a Valuation article from 2007, Tim Lowe, CRE, asserted, "During the last 25 years, commercial real estate appraisers have put their eggs in the financial analysis basket… now, he observes, they will have a change of focus to building performance" (Nicolay).

4.2 Focus upon the net present value of the stream of benefits. Due to the previously explored inherent limitations with the Sales Comparison Approach (lack of recent and specific data) and the Cost Approach (lack of differentiation), the Income Approach appears poised to serve as the likely primarily indicator of value for high performing buildings. Many appraisers may respond that the truest measure of value is the market's willingness to pay, not net income. However, the author of this paper argues that because data relevant to market response to these factors is limited (in the absence of market information), "NOI [net operating income] capitalization may indeed be a close proxy for empirical market information" (Chao 12). Furthermore, the DCF appears particularly relevant given the intrinsic design of the model.

Specifically, DCF involves the calculation of the present value of an income stream and reflects the manner in which costs and revenue streams can be impacted by green features over time. Particular to the DCF is the “conceptual framework that enables the user to integrate quantitative and qualitative analysis to measure sustainable property financial performance”(GBFC). DCF can also better reflect investor motivations, can discount any cash flow pattern, can be compared to other investment alternatives, and does not require inputs that are directly extracted from comparable sales. Given the potential for regulatory change requiring energy efficient measures, as well as related likelihood that less efficient buildings will be perceived for their obsolescence in the market place, DCF would allow for a reflection of the mitigated risk present in the more sustainable properties. As time passes, and with all things remaining equal, the higher performing buildings tend to result in higher NOIs, lower discount rates, and subsequently higher overall values relative to their conventional counterparts.

4.3 Additional data requirements. As Theddi W. Chappell, MAI has reflected regarding the valuation of green properties, “Although basic appraisal methods won’t change, more factors will have to be considered” (Nicolay 17). As alternative energy forms continue to mature and sustainable buildings are constructed with positive net energy production which could be sold back to the larger grid infrastructure, value considerations could then take into account the impact of the net energy production in the income approach. For example, additional considerations may include, but not be limited to, such factors as: efficiency levels power usage effectiveness (PUE); net energy potential; energy use intensity (EUIs); and/or carbon offset opportunity. A new industry think tank, the Green Building Finance Consortium, has been formed to grapple with this, and many related issues. The US DOE, under its Commercial Building Energy Alliance, has also initiated development of a a performance metric based upon various tier levels in the process of fundamental development. As sustainability and environmental self-reporting become more common (most annual reports to stockholders are including them), this type of information will continue to become increasingly available.

It is important to note that any and all additional performance based measurements and related integrations in the DCF in any appraisal analysis must be made subject to an effective commissioning process. The validity of the newly integrated metrics on value will only be as reliable as they are verifiable. Commissioning is the third party verification of a building's system performance. Proper commissioning assures that systems perform in accordance with project requirements. An appraisal subject to a properly commissioned building bases valuation assumptions upon already verified and on-going verifiable building performance assumptions.

4.4. Summary. "As with business as a whole, metrics must not lead our decisions, they must inform them" (Moss). Appraisers are not being asked to become experts in building science, nor are they being asked to collect primary data. They are, instead, being asked to prioritize performance levels, focus on streams of net benefits, and to be willing to consider additional information beyond what is typical in a standard appraisal. Exploration of all of the potential data sources which could augment the appraisal process to provide said additional information are beyond the scope of this manuscript. Sufficed to say, as the industry continues to evolve, new sources will continue to become available. Refinement of available data, and its applicability to appraisal methodology will also be required over time.

5. Hypothetical Green Metric Application Case Studies

The following section outlines hypothetical applications of a proposed green metric with a focus upon high performance properties, damaged properties, and a market environment that prices carbon.

5.1. Upon Highly-Performing Properties. High performance properties that integrate sustainable elements into building design and operation have the ability to positively impact property values. The ability to impact value depends upon the unique combination of environmental attributes incorporated into a specific environmental design. Just as the number of green choices in property construction, design, and

maintenance are unlimited and specific to a particular property, so too, are the potential ways in which these green attributes can influence value. An appraiser, recognizing the inherent economic value of information, will better understand the manner in which value may be impacted by better understanding the net effect of environmental attributes upon building performance.

In the case of a highly-performing building, the appraiser could integrate both a qualitative and quantitative green metric into their analysis. The property description would include a detailed examination of sustainable property design characteristics. Additional property description data being recommended herein will require appraisers to educate themselves regarding trends in building science and the benefits and costs associated with new green techniques. Qualitative analysis would include a market analysis section dedicated to examination of social, economic, government controls and environmental conditions impacted by and related to the aforementioned sustainable property design characteristics.

In the case of quantitative data regarding performance levels, the appraiser would specifically want to know how the subject features are expected to compare overall (ie. in terms of reduced operating costs) relative to a conventional building without those specific features. While paired sales would be preferred, it is more likely that quantitative data provided to the appraiser would be in terms of energy performance levels (from an energy auditor) as well as documentation provided by sustainability rating tools (such as LEED). The key point regarding the data upon which the quantitative analysis is provided is that would be provided by a third party expert who has actually measured *specific energy performance for the subject property*. The appraiser would then integrate relevant data into a standard DCF model the assumptions regarding operating costs as provided by the energy auditor data from the subject building. As previously noted, any and all assumptions in an appraisal report that assume specific efficiency levels should then be qualified and documented in the appraisal as subject to a properly commissioned building.

An alternative to actual energy data from an energy auditor or manufacturer, would be development of an continuum of energy performance-to-value-influences. The appraisal community could initiate a collaborative effort between the energy auditing community, researchers, academics, and related private parties and non-profits with the purpose of articulation of a market-accepted range of typical cost reductions and life cycle benefits associated with a continuum of sustainability attributes. The continuum could be as simple as a recommended (and market-supported) overall operating cost reduction (assuming a specified green lease arrangement) matrix dependent upon the type of and extent of green features. Alternatively, the continuum could be complex and detailed and similar in fashion to Marshall & Swift, with reductions linked to property type, construction quality, specific attributes present, and the like.

5.2. Upon Damaged Properties. Valuation of damaged properties is a specialty field with prominent experts such as Randall Bell, Dr. Thomas Jackson, Orell Anderson, and Michael Sanders leading the pack in terms of knowledge and theory. Recommended methodologies include guidance provided by Advisory Opinion 9, as well application of retroactive value based upon a theoretical continuum ranging from no impact to a complete loss in value or liability. While traditional appraisal techniques provide the foundation for analysis of real estate damages, examination also includes a complex damage analysis. The Bell Chart, for example, provides a “framework showing the relationship of time and value with a variety of graphical patterns, depending on the relevance and impact of each value issue during each stage” (Bell 20). Additional information provided by the Bell Chart is relevant to understanding factors impacting value to the subject property.

Just as the examination of damages data (additional information) are vital components of analysis for a property that is contaminated, so too, is the integration of a metric that measures aspects of sustainability for all real estate. The sustainability component provides information considered relevant, given growing environmental consciousness and related market force influences. Say, for example, a property was subject to extreme environmental damages (ie. oceanfront property adjacent to an oil spill) but due

to the unique combination of property attributes (high winds) was also poised to provide surplus energy production (wind turbines). Depending upon highest and best use analysis, it is possible that the net impact on value resulting from integration of the green metric would result in a different opinion of value had it not been previously considered. Furthermore, inclusion of the green metric would help to more appropriately value, and subsequently allocate, resources in a more efficient fashion under our revised economic (and environmental) circumstances.

5.3. Within an Economy Wherein Carbon is Priced. Although many other greenhouse gases have similar thermal radiation properties, carbon dioxide is the most abundant, most studied, and the most likely to be subject to a pricing structure. Whether it is mandated or voluntary, regional or international, future reductions in carbon emissions appear to be on the horizon. Placing a price on carbon results in a market based approach wherein energy is priced closer to its cost to society once risks are factored in. Integration of a green metric that is sensitive to relevant trends and preferences in the market as they relate to carbon pricing would help to capture value appropriately under this revised scenario. In response to a carbon pricing system, there are some hypothetical but interesting new values that would be direct, monetary, and exclusive to property owners and could affect value. Examples include-

- Buildings that rely upon alternative energy sources for power will have a distinct advantage in an economic system wherein carbon is priced. As carbon emissions are priced, the cost of producing energy from fossil fuel based energy sources will increase. All other factors being equal, alternative energy sources will become more competitive. As the quantity demanded for alternative energy sources increase, economies of scale will result in greater efficiencies in alternative energy production, thereby normalizing the cost of alternative energy over time and increasing its profitability. It would then stand to reason that buildings that derive energy from alternative energy sources would reflect reduced risks in their relevant capitalization and/or discount rates.
- Alternatively, under a carbon pricing system, value creation would be direct, monetary, and exclusive based upon the characteristics of the real estate. An

example of this would be the case of a rural property owner who possesses stores of biomass created by perennial vegetation such as root systems and tree trunks. Carbon credits theoretically could be earned based upon the carbon sequestration potential of that property. Value creation under a carbon banking system could potentially resemble the paradigm of wetland mitigation banking system wherein credits are given for creating, enhancing or restoring wetland functions in an area. As the carbon finance market continues to develop, and emissions trading mechanisms evolve, a pricing system for carbon sinks will likely emerge as supply and demand interact over time.

- Yet another example could relate to the ability of a property to produce energy. Assuming that carbon emissions are priced, then alternative sources of energy would become more in demand. The “fuel” necessary to power the green energy sources would become more valuable in this revised economic system. For example, think of the case of a landowner outside of Phoenix, Arizona who in yesterday’s market had his commercial real estate holdings decimated by the downturn in the market. In tomorrow’s carbon priced market, he could turn his land profitable again by leasing the right to harness the sun.
- As global negotiations to limit emissions continue, as agreements take shape, and as recognition grows that environmental issues do not respect political boundaries, then international markets will respond appropriately. International acceptance of a green metric provides a common denominator, a transparent benchmark through which to properly value environmental attributes in our increasingly global world economy. Over time, integration of an internationally accepted green metric will help account for sustainability factors and conversion for application to national triple bottom lines, in the same general fashion that foreign exchange rates provide for conversion of values across currencies.

Further research in this area is necessary, to not only promote understanding of possibilities, but also to illuminate the manner in which environmental protection and natural resource preservation can go hand-and-hand with economic growth, job creation, and national security.

5.4. Summary. Hypothetical integration of a green metric under the aforementioned scenarios demonstrates the manner in which changing circumstances could be addressed within a sustainable framework. Consistent application of a well-designed green metric that captures and adequately quantifies the influence of sustainable features will reflect related shifts in market forces, promote more efficient resource allocation, as well as best capture value created.

6. Conclusion

There is an urgent need for a sea change in our valuation methodology as it relates to the articulation of green attributes and their impact on value. Economic constraints within an age of growing environmental awareness have resulted in a marketplace wherein sustainability considerations have increasing relevance. The green metric should be designed based upon our existing body of knowledge with the purpose of improving the quality and quantity of available information and effectively integrating market transformations.

Development of green metric is necessary and possible. Appraisers are urged to aggressively forge ahead with development of a consistently applied and internationally accepted green metric. Incorporation of this green metric into appraisal methodology on an international level will provide a transparent benchmarking system through which to value sustainability attributes in our increasingly global (and environmentally aware) economy. Future benefits of an effective green metric include more efficient markets, more optimal resource allocations, and more sustainable economic and environmental systems over the long-term.

Bibliography

Bell, Randall. Real Estate Damages, 2nd Edition. Chicago: The Appraisal Institute, 2008.

Cannon, Ujjval Vyas and Susanne. “Shifting the Sustainability Paradigm: From Advocacy to Good Businesss.” Real Estate Issues (Volume 33, Number 3): 2008.

Chao, Mark. Recognition of Energy Costs and Energy Performance in Commercial Property Valuation, et al. Institute for Market Transformation. CA: PG&E and US EPA, 1999.

Company, Grubb & Ellis. Meeting the Carbon Challenge. Info Sheet. Chicago, IL, April 2007.

EIA. Energy Information Administration Annual Energy Review 2008. Washington, DC: US Department of Energy, 2008.

—. Energy Information Administration International Energy Outlook. Washington DC: US Department of Energy, 2010.

EPA. "Buildings and their impact on sustainability." 22 4 2009. 22 8 2010 <http://www.epa.gov/greenbuilding/pubs/gbstats.pdf>.

Fur, Jonathan E. Green Building and Sustainable Development, A Practical Legal Guide, et al. Washington DC: ABA Publishing, 2009.

GBFC. “DOCUMENTING GREEN BUILDING VALUE.” The Appraisal & Underwriting Process. San Rafael: Powerpoint presentation- Session 204, Greenbuild 2006, 2006.

Grubb&Ellis. Meeting the Carbon Challenge. INSIGHT Info Sheet. Chicago, IL, April 2007.

Hayek, Friedrich. “Knowledge in Society.” American Economic Review XXXV, No. 4 (1945): 519-530.

Institute, Appraisal. The Appraisal of Real Estate, 12th ed, et al. Chicago: Appraisal Institute, 2001.

Jackson, Jennifer Pitts and Thomas. "Green Buildings: Valuation Issues and Perspectives." The Appraisal Journal (Spring 2008): 116.

LaSalle, Jones Lang. “Perspectives on sustainability, et. al.” Results of 2009 global survey on corporate real estate and sustainability. Jones Lang LaSalle and CoreNet Global, 2009.

Lenssen, D.M. Roodman and N. A Building Revolution: How Ecology and Health Concerns are Transforming Construction. Worldwatch Paper 124. Washington,DC: Worldwatch Institute, 1995.

McKinley, Michael. The Appraisal of Real Estate, 12th ed. Chicago: Appraisal Institute, 2001.

Moss, Ken. "Green Economy Post." 11 9 2009. The Role of Metrics and ROI in Corporate Responsibility. 23 7 2010 <http://greeneconomypost.com/metrics-roi-corporate-responsiblity-4441.htm>.

Muldavin, Scott. "Value Beyond Cost Savings: How to Underwrite Sustainable Properties." 2010. Green Building FC. 23 7 2010 <http://www.greenbuildingfc.com>.

Nicolay, Claire. “The Greening of Real Estate Appraisal.” Valuation (2nd quarter 2007): 15-19.

Reay, C.N. Hewitt, et al. Green House Gas Sinks. Cambridge, MA: CAB International, 2007.

Reed, Richard. "International Comparison of Sustainable Rating Tools, et al." JOSRE (2009): 1.

Roth, Robert. "CostarJOSRE." 23 7 2010. Costar. 23 7 2010 <http://www.costar.com/josre/pdfs/Green-JOSRE-A-Performance-Based-Real-Property-Valuation-Model-Roth.pdf>.

Simmons, Alan. “An Introduction to Green Homes.” Simmons, Alan F. An Introduction to Green Homes. Chicago: Appraisal Institute, 2010. Forward.

—. "Introduction to Valuation of Green Buildings." Introduction to Valuation of Green Buildings, Online Education Document. Chicago: Appraisal Institute, 2009.

Union, The World Conservation. Caring For the Earth, A Strategy for Sustainable Living. Gland, Switzerland, October 1991.

Wiebe, Keith. “Managing Public and Private Land Through Partial Interests, et al.” Contemporary Economic Policy (1997): 35-43.