Sustainability and Income-Producing Property Valuation: North American Status and Recommended Procedures

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Abstract The valuation of property with “sustainability” aspects is not a new property type nor does it call for a deviation from the traditional valuation methods for the appraisal of income-producing properties. However, there can be numerous and significant differences between sustainable and traditional properties that appraisers must consider, research, and address. This paper provides the first systematic procedure for evaluating sustainable property with practical guidance and advice for the integration of this procedure into the valuation process for appraisers, developers, building owners, real estate investors, lawyers, and other consumers of appraisal services. The proposed procedure is consistent with the “valuation process” promulgated by the Appraisal Institute while being consistent with the Uniform Standards of Professional Appraisal Practice, as well as the methodological and conceptual valuation literature.

The theoretical basis for the integration of sustainability considerations into the property valuation process began in 1996 [see Harrison and Seiler (2011) and Lorenz and Lützkendorf (2011) for a history of this topic]. However, the North American history of guidance for the appraiser, excluding specialized or academic journals that are not typically utilized by practitioners, is much less extensive, and includes the following:

- 2007 the Vancouver Valuation Accord meeting of valuation organizations, standards owners and implementers from 131 countries agreed to work towards embedding sustainability with valuation practices;
- 2009 Valuation Insights and Perspectives article “Finding Green in Sustainability: How to get in on the ground floor of this fast-moving trend;”
- 2009 Valuation Insights and Perspectives article “Valuing Sustainable Leases;”
prepared by a government, non-profit and private industry collaborative in the United States and Canada;

- 2008 Appraisal Institute offered one-day seminars on “Introduction to Valuation of Green Commercial Buildings” and “Valuation of Green Residential Properties;”

- 2008 Appraisal Institute book entitled An Introduction to Green Homes;

- 2010 The Green MLS Tool Kit, a collaborative effort among industry experts, including the Appraisal Institute, was developed to help Realtors® and appraisers more effectively consider the characteristics of high-performing homes;

- 2010 Appraisal Journal paper entitled “Valuing High Performance Houses;”

- 2010 Journal of Sustainable Real Estate paper entitled “Integrating Sustainability and Green Building in the Appraisal Process;”

- 2010 Appraisal Institute launched its Valuation of Sustainable Buildings Professional Development Program consisting of three one- and two-day courses on the valuation of high-performance residential and commercial buildings;

- 2011 Valuation Insights and Perspectives article entitled “Seeing Green: The Six Elements of Green Building and Tips for Supporting Appraisals;” and


Aside from these introductory materials/courses, there is currently a lack of comprehensive educational material and practical guidance on the integration of sustainability aspects into the educational programs for North American appraisers.

Lorenz and Lützkendorf (2011) identify four main arguments for the need to integrate sustainability aspects into the appraisal process. First, it is required by the transactions observed in the market place (sale prices, rents, marketing time-frames, marketing costs, etc.) and already foreseeable market developments (such as rising energy costs, changing and differentiated user requirements, environmental legislation, and sustainability reporting liabilities). Second, the professional ethics of the valuation profession and the resulting responsibility towards society dictate that valuation professionals take action to further advance sustainable development within the property and construction sector. Third, poor property valuation (i.e., a continuation of valuation business as usual) can lead to a misallocation of capital and the degradation of financial, natural, and social resources. For this reason, Muldavin (2010) argues that in the past, the failure of property investors and their professional advisors to appropriately incorporate revenue and risk considerations into sustainable investment decisions has led to an under-investment in sustainability. Today, with ever more stringent...
governmental regulations and growing market participants’ interest in sustainability, this failure will increasingly result in suboptimal financial results for investors and, as a consequence, in society’s inability to achieve goals related to carbon reduction and other sustainability issues. Fourth, the lack of awareness of certain market participants regarding the relationships between the sustainability performance of buildings on the one hand and property risks and financial performance on the other leads to a situation where individual property assets are mispriced (hypothesis: conventional properties can be sold “overpriced” while sustainable buildings are “underpriced”), which in turn results in arbitrage investment opportunities for “enlightened” investors.

In fact, Lorenz and Lützkendorf (2011, p. 654) state: “Sustainability issues play a role in any valuation assignment, including the valuation of conventional buildings, because such buildings are already associated with higher risks (e.g., faster obsolescence and shorter remaining economic lifespan), which must be considered and priced today; this is particularly true whenever an income-producing property is valued by discounting and/or capitalizing the property’s net income. The nature of underlying logic of this valuation method simply requires that future risks (which are already foreseeable today) be considered when selecting appropriate discount or capitalization rates.”

This paper provides the North American appraiser, developers, building owners, real estate investors, lawyers, and other consumers of appraisal services with a roadmap to the appraisal of income-producing properties with sustainability considerations that is consistent with the “valuation process” of the Appraisal Institute, the Uniform Standards of Professional Appraisal Practice (USPAP), and the methodological and conceptual valuation literature.¹

**Definition of Sustainability: Development and Buildings**

Although sustainability has many definitions and interpretations, a widely-accepted definition of sustainable development is from the 1987 (p. A/42/427) report of the Bruntland Commission: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” The original intent of sustainable development included concerns of social equity between generations, basic global living standards, non-exploitation of others, and reducing the rate of consumption of non-renewable resources.

The adaptation of the global perspective of sustainable development to the real estate industry has resulted in a reference to “sustainable design,” “sustainable construction,” “high performance building,” “green architecture,” “green construction,” and “green building.”² Properties that lack sustainability characteristics are often referred to as “traditional,” “conventional,” “unsustainable,” or “brown.” Whatever the descriptor for a building that has sustainability aspects, there is general agreement that when sustainable buildings are planned, constructed, and operated, the expectation is that they will offer high
quality in terms of urban integration, architectural design, functionality and technical infrastructure while simultaneously responding, with equal priority, to economic environmental and social requirements (Lützkendorf and Lorenz, 2007).

Within the built environment in North America, the National Association of Home Builders has described “green construction” as paying attention to energy efficiency, water and resource conservation, the use of sustainable or recyclable products, and measures to protect indoor air quality. The Appraisal Institute’s definition in *The Dictionary of Real Estate Appraisal* (2008, p. 192) is more globally-inclusive, as “the practice of developing new structures and renovating existing structures using equipment, materials, and techniques that help achieve long-term balance between extraction and renewal and between environmental inputs and outputs, causing no overall net environmental burden or deficit.”

Definitions aside, and recognizing that there are varying levels of a building’s sustainability or greenness, there is general agreement (e.g., Lorenz, Trück, and Lützkendorf, 2006; Warren-Myers and Reed, 2010) that the ideal sustainable buildings strive to achieve a reduction of the overall impact of the built environment on human health and the natural environment by: (1) reducing land use or environmental impact by not building in sprawl or a location that results in the spreading of development outwards from a city or suburbs to low-density and auto-dependent locations; (2) minimization of lifecycle costs by considering a cradle-to-grave analysis of all impacts associated with the building from extraction of the raw materials through manufacture, use, repair, maintenance, disposal, and recycling (Royal Institution of Chartered Surveyors (2009); (3) siting and structure design efficiency; (4) conservation of resources (energy efficiency, water efficiency, materials efficiency); (5) indoor air quality (IAQ), thermal quality, lighting quality, and safety to provide enhanced occupant comfort, well-being, and productivity; (6) operations and maintenance optimization; (7) waste and toxics reduction in the construction process and operation/use; and (8) optimization of one or more of the above to produce a greater cumulative effect.

Most North American appraisers will recognize the “valuation process” from *The Appraisal of Real Estate* (2008, p. 129) defined as “a systematic set of procedures an appraiser follows to provide answers to a client’s questions about property value.” The eight steps in the valuation process are depicted in Exhibit 1.

### Step 1: Identification of the Problem

In Step 1 of the valuation process, the development of an understanding of the appraisal problem to be solved applies equally to sustainable and unsustainable valuation assignments. The identification of the appraisal problem involves the identification of the following: client; intended users of the appraisal; intended use of the appraisal; type of value, its definition, and the source of the definition; effective date of the opinion of value; relevant property characteristics for the property type, and intended use of the appraisal; and assignment conditions...
such as extraordinary assumptions, hypothetical conditions, and jurisdictional exceptions.

Most of the issues in this step of the valuation process are likely to have been addressed with the client prior to accepting the assignment. It is during this process and the Scope of Work Determination that the appraiser must address whether or not the appraisal of a property with “sustainability” aspects can be completed competently.
Step 2: Scope of Work Determination

Appraiser Competence

The Competency Rule of the USPAP (2012–2013, p. U-11) states: “The appraiser must determine, prior to accepting an assignment, that he or she can perform the assignment competently. Competency requires: (1) the ability to properly identify the problem to be addressed; (2) the knowledge and experience to complete the assignment competently; and (3) recognition of, and competence with, laws and regulations that apply to the appraiser or to the assignment.”

In addition to the standard issues of an appraiser’s familiarity with the market area, property type, geographic area, intended use, specific laws and regulations, or analytical method, a property with sustainability aspects may require competence in a wide variety of additional areas. For example, in 2008 the Institute of Green Professionals, an international credentialing and education organization for sustainable-development professionals (ceased operations in 2010), developed Literacy Elements for Sustainable-Development Professionals (see the Appendix). These literacy elements were derived from a consensus opinion of over 500 individuals working and teaching sustainability in disciplines of architecture, land-use planning, landscape architecture, engineering, real property valuation, accounting, and law. Many of these literacy elements could be considered basic elements of an appraiser’s competency for the valuation of a property with sustainability aspects.

Looking at the future education of professionals that work with sustainable property, it is suggested that sustainability will soon be “systematically embedded within the curriculum to the benefit of professionals, professional bodies and educators” (Murray and Cotgrave, 2007, p. 7).

Reliance on Reports of Others

Few appraisers are familiar with the detailed aspects of green building design, construction, operation, and maintenance. Therefore, in the assessment of a property’s sustainability characteristics, most appraisers will utilize scientific and other technical evaluators or reports prepared by others such as architects, engineers, and rating systems. In these situations, USPAP instructs the appraiser to utilize an extraordinary assumption regarding the information obtained from other experts that is used in the appraisal.

With reliance on the reports of others, appraisers are reminded of USPAP’s (2012–2013, p. U-30) SR 2-3, which states, in part: “When a signing appraiser(s) has relied on work done by appraisers and others who do not sign the certification, the signing appraiser is responsible for the decision to rely on their work. The signing appraiser(s) is required to have a reasonable basis for believing that those individuals performing the work are competent. The signing appraiser(s) also must have no reason to doubt that the work of those individuals is credible.”
Additionally, where the appraiser relies upon another expert to provide an opinion on a factor that directly impacts value (e.g., energy savings), the appraiser should consider having the other professional “hold harmless, defend and indemnify” the appraiser for any disputes over the sustainability value input(s).

**LEEDigation and Green Building Litigation**

The last two decades have seen the increasingly rapid development of a variety of green rating systems designed and marketed to measure the environmental impact of particular products and building design elements. Most green building programs share much in common with the two most well-known national green rating systems: the Leadership in Energy and Environmental Design (LEED) systems and the Green Globes program. Like rating systems for other products and processes, these building programs include some that are self-certifying and others that rely on a system of third-party verification.

LEEDigation was first coined and defined by Cheatham (2009) as follows: “LEEDigation is green building litigation. LEEDigation could involve disputes arising from green building certification. LEEDigation could arise if a project fails to obtain government incentives or satisfy mandates for green building construction. LEEDigation could simply result from improperly designed or constructed green building strategies.”

LEEDigation is a special case of green building litigation and generally falls into three types of legal issues: (1) regulatory non-compliance; (2) green building certification; and (3) means, methods, and materials. These disputes can arise from improperly designed or constructed sustainability aspects, project costs increasing, construction delays, new technologies not working as planned, an owner’s or tenant’s unsatisfied expectations, failure to obtain government incentives, completed buildings not achieving the expected rating (e.g., LEED), buildings not achieving the expected energy savings, and similar issues.

Any party in the green building project (e.g., developers, contractors, subcontractors, construction professionals) faces potential liability for the performance of the building and other issues. The appraiser is not immune to liability and is cautioned to utilize extraordinary assumptions and reliance on the scientific and other technical reports prepared by other professionals with regard to the following non-exhaustive list of issues, many of which impact value opinions: (1) status of the property with respect to regulatory compliance; (2) status of the property with respect to rating system (e.g., LEED); (3) energy expense projections/savings (e.g., the technology in some micro-generation systems may be insufficiently developed so that there may be no savings over its life cycle), although some occupiers may demand these components and their presence may have an impact on marketability, demand, and value; (4) income projections higher than indicated by current market comparables; (5) expense projections lower than indicated by current market comparables; (6) replacement costs of specialized building materials and equipment; (7) continuity of the source of energy with renewable technologies such as wind generators and solar panels (e.g., in the event that the supply of energy to the building cannot be secured due
to inadequate grid capacity); and (8) other risk factors that may be relevant to a property with sustainability aspects.

Prum (2012, p. 2) suggests that for high performance buildings where special skills or knowledge is required of a professional, the courts will likely “impose an elevated standard of care to act reasonably based on their superior learning and experience.” Prum recommends, that while no case law has definitively resolved the appropriate standard of care for professionals on green building projects, it is wise to avoid this “untested corner of common law” by “taking a proactive approach with language of their choosing that stipulates the level they want applied in their agreement.” Therefore, appraisers, like other parties entering an agreement concerning a green building, are cautioned to make modifications to their client contract to address specific issues underlying the valuation of a sustainable property (e.g., reliance on reports of other professionals, extraordinary assumptions).

Other Considerations for Scope of Work Determination

In addition to the standard elements of the appraiser’s scope of work for an income-producing property, in order to fully integrate sustainability aspects into the valuation process and to appropriately consider the additional work required (and quote an appropriate fee), the scope should consider: (1) an expanded description of the property’s sustainability-related building characteristics, possibly supported by other expert reports; (2) a significantly more detailed analysis of the sustainability-related characteristics of the comparables, which may include a comparison of the energy modeling against comparable operational data; (3) capturing market participants’ awareness of the property’s sustainability attributes, property-related benefits, and risks; (4) a transparent and descriptive sub-analysis to support qualitative and quantitative adjustments; and (5) an expanded sensitivity analysis and/or Monte Carlo simulations and/or survey research.

Step 3: Data Collection and Property Description

Step 3 consists of the collection of market area data, subject property data, and comparable property data.

Market Area Data

Of particular relevance for a subject property with sustainability aspects is capturing the general characteristics of the region, city, and neighborhood as they may impact trends, overall supply, demand and marketability.

Subject Property Data

The following sustainability characteristics should be considered by the appraiser. This is not an exhaustive list because assessing a property’s sustainability characteristics is a complex activity wherein stakeholders may have different
interpretations of the concept of sustainability and the physical structures can be complex.

**Building Certification.** Describe the subject and comparables building certification type, if any. For example, LEED, Green Globes, NAHB Green Home, ENERGY STAR, and Canada Green Building Council (CGBC) are recognized programs in North America. Sustainability assessment tools use prescriptive standards as opposed to valuation standards but they do provide valuable information to be able to make building comparisons. A green building certification or rating does not provide actionable information about the cost or market value of a building. There are different methods to acquire certification points or credits, many of which have little to do with the construction of the building (e.g., site selection or green building materials). Therefore, appraisers need to assess the actual building components and valuation-input parameters extracted through an analysis of comparable properties and of supply-demand relationships.

**Land Use/Site.** The appraiser’s analysis of the subject site will consider the natural site conditions, the climate, the rock bed and soil conditions, noise, and potential impacts of contamination for brownfield locations, as follows:

1. A site for the construction of a new building with sustainability aspects may utilize the site’s inherent features including trees for shade and water as a visual amenity.

2. For the construction of a new building with sustainability aspects or for the renovation of an existing building for sustainability aspects, the climate and natural energy sources may be considered. For example, the analysis of wind-flow patterns to maximize the use of natural ventilation and consideration of the seasonal and daily path of the sun across the site to minimize or maximize the impact of this natural energy source. Appraisers are cautioned to consider solar access laws and the potential for solar access conflicts on the site.¹⁰

3. A site for the construction of a new building with sustainability aspects will avoid sites with site-sensitive elements and restrictive land types (e.g., high-functioning wetlands, floodplains, other natural areas, igneous and metamorphic rock that could release radon, sites with soil conditions that are subject to subsidence, creep, and landslides, sites that have the potential for significant degradation of the natural environment).

4. Developers of buildings with sustainability aspects will typically avoid sites with high noise levels such as those near airports, major highways, or railways. Where noise is unavoidable, several different noise mitigation methods can be utilized such as green roofs, higher-quality window and building materials, natural site features (e.g., landscaping, berm), and/or manmade sound barriers (e.g., absorptive or reflective acoustical fences).

5. While the construction of a building on a brownfield may result in a higher score for a sustainability development rating system, the appraiser must consider the potential negative impacts of contamination, such as the cost of monitoring, insurance, indemnification, future liabilities, risk of offsite migration, increasing impact of climate change through soil...
erosion (tidal, fluvial, and surface water), wind, and other climactic actions with potential cost and value impacts. The consideration of environmental contamination is addressed in the USPAP (2012–2013) AO-9 including the Competency Rule, relevant property characteristics, specialized terms and definitions, and issues involved in valuing potentially impacted properties as if unimpaired and as impaired.

6. In the valuation of a proposed development on a brownfield or other sites with contamination, the appraiser should consider government financial incentives together with the potential for increased operating costs and risks of contamination.

Building Design. The design characteristics of sustainable properties typically include components designed to achieve longer lifecycles. They will have different resource utilization or ecological footprints and/or design features that can impact a property’s investment characteristics.

Corps (2008) and Pivo (2010) argue that it is more important to make improvements to existing property performance than developing better new facilities because existing properties comprise the bulk of the income-producing market. This means that the vast majority of appraisal assignments involving sustainability aspects will be for existing properties that did not begin as sustainable properties.

The appraiser should consider the following building components:

1. The appraiser should consider the quality of the building, its use (including end-of-life use and adaptation), its characteristics, and location, as it relates to market expectations. A building constructed of durable, reusable or recyclable materials may be less likely to suffer premature obsolescence and may have decreased costs of updating or modifications. A sustainability design characteristic will typically consider climate change and its potential impacts on the property and environmental hazards such as floods and storms. For buildings nearing the end of their economic life, the appraiser may consider the value of recycled or reusable materials upon deconstruction (e.g., a positive cash flow input in the reversionary year of a discounted cash flow analysis).

2. Design efficiency should be considered in terms of gross building area, finished building area, and leasable building area. Energy costs, as impacted by design efficiency, can have an impact on tenant costs, occupancy percentage, operating expenses, marketability, and market value.

3. Good resource efficiency and operating cost savings can be achieved through sustainable technology (e.g., solar, wind, water reuse, low-flow fixtures, occupancy sensors). Each type of technology should be assessed with regard to its initial cost, cost of maintenance, whether it has a long history of use and reliability or is relatively new and untested.

4. Flexibility in use potential, particularly for offices, allows for tenant changes in the future at less refit cost with less functional obsolescence.
Recently, office workspaces have changed, with a more collaborative workspace or a more flexible area for employees, and an open floor plan that costs less to build and decorate.

5. The highest and best use of the land or building will likely change over time. A building with a structural design that allows for change of use and/or user is inherently more sustainable. A building that can be adapted for an alternate or higher and better use rather than demolition is less of a burden on resource depletion and is likely to suffer less obsolescence.

6. Companies located in buildings with superior indoor environmental quality including improved indoor surroundings (lighting, ventilation, acoustics, and ergonomic design) have been found to have less absenteeism (for asthma, allergies, depression, and stress-related conditions) and higher productivity (e.g., Syal, Grady, and Korkmaz, 2009; Heerwagen, 2010). The appraiser needs to investigate whether the market participants (owners and users) understand these benefits, and the market impacts, if any, on factors such as tenant lease-up, rental rate, lease term, roll-over probability, marketability, and market value.

7. The appraiser should consider other sustainability design qualities of the subject property and comparable properties that the market demands, such as convenient and secure facilities for bicycles, sustainable vehicle parking, showers, lockers, and a green roof for an occupant park.

**Building Materials.** Where a building or its components are approaching the end of their economic life, any hazardous materials will have an impact on the ability of the materials to be recycled or reused. This has a quantifiable impact on the cost of rehabilitation or demolition, and land value. The appraiser should seek expert opinions on potential hazards of building materials and cure, remediation and/or removal costs. The most common building material hazards are: (1) respirable silica in sand, concrete, brick, Portland Cement, ceramic tile, stone, and other materials made of stone or earth; (2) lead in paint, plumbing, solder, connectors, roof flashings, and in fasteners; (3) asbestos in insulation, boilers, pipe covering, plaster, vinyl floor tile, glazing compound, caulking compound, roofing materials, drywall board and taping compound, linoleum, flooring, and other adhesives, acoustical materials, fireproofing insulation, and exterior siding materials; (4) polychlorinated biphenyls (PCBs) in electrical transformers, light fixture ballasts, and in other electrical equipment; (5) glass fiber in insulation and as reinforcement in plastics; (6) mineral wool in insulation and as reinforcement in vinyl composition floor tiles; (7) cadmium as a rust inhibitor on hardware and in paints; (8) asphalt as a sealant in adhesives and in many roofing materials; and (9) radioactive isotopes in ionization-type smoke detectors and compact fluorescent lamps.

Sustainable building materials and products may have a significant impact on the building characteristics and demand for the sustainability-focused owner and tenant because they can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling,
and disposal of these building source materials. According to the California Department of Resource Recycling and Recovery (2012), the use of sustainable building materials can provide reduced maintenance/replacement costs over the life of the building, energy conservation, improved occupant health and productivity, lower costs associated with changing space configurations, and greater design flexibility. Their material/product selection criteria are as follows:

1. **Resource Efficiency:** Accomplished by utilizing materials that meet the following criteria:
   a. **Recycled Content:** Products with identifiable recycled content, including postindustrial content with a preference for postconsumer content.
   b. **Natural, Plentiful or Renewable:** Materials harvested from sustainably managed sources and preferably have an independent certification (e.g., certified wood).
   c. **Resource-efficient Manufacturing Process:** Products manufactured with resource-efficient processes including reducing energy consumption, minimizing waste (recycled, recyclable, and/or source-reduced product packaging), and reducing greenhouse gases.
   d. **Locally Available:** Building materials, components, and systems found locally or regionally saving energy and resources in transportation to the project site.
   e. **Salvaged, Refurbished, or Remanufactured:** Includes saving a material from disposal and renovating, repairing, restoring, or generally improving the appearance, performance, quality, functionality, or value of a product.
   f. **Reusable or Recyclable:** Select materials that can be easily dismantled and reused or recycled at the end of their useful life.
   g. **Recycled or Recyclable Product Packaging:** Products enclosed in recycled content or recyclable packaging.
   h. **Durable:** Materials that are longer lasting or are comparable to conventional products with long life expectancies.

2. **Indoor Air Quality:** Enhanced by utilizing materials that meet the following criteria:
   a. **Low or Non-toxic:** Materials that emit few or no carcinogens, reproductive toxicants, or irritants, as demonstrated by the manufacturer.
   b. **Minimal Chemical Emissions:** Products that have minimal emissions of Volatile Organic compounds (VOCs). Products that also maximize resource and energy efficiency while reducing chemical emissions.
   c. **Low-VOC Assembly:** Materials installed with minimal VOC-producing compounds, or no-VOC mechanical attachment methods and minimal hazards.
   d. **Moisture Resistant:** Products and systems that resist moisture or inhibit the growth of biological contaminants.
e. **Healthfully Maintained:** Materials, components, and systems that require only simple, non-toxic, or low-VOC methods of cleaning.

f. **Systems or Equipment:** Products that promote healthy IAQ by identifying indoor air pollutants or enhancing air quality. Rating systems also consider natural light and designs that allow it to impact interior areas, such as transom lights and use of outdoor air, such as operational windows.

3. **Energy Efficiency:** Maximized by utilizing materials, components, and systems that help reduce energy consumption.
   a. **Water Conservation:** Utilize materials and systems that help reduce water consumption in buildings and conserve water in landscaped areas.
   b. **Affordability:** Consider when building product lifecycle costs are comparable to conventional materials, or as a whole, are within a project-defined percentage of the overall budget.

The selection of sustainable building materials can impact the cost of servicing and replacing the materials. The ability to reuse, repair, and replace materials will typically improve their lifecycle value (defined as the cost or value of the material divided by its useful life, adjusted for any value as a recyclable asset, and adjusted for its waste value and carbon footprint). The use of sustainable building materials may impact the appraiser’s estimate of maintenance and repair cost, especially when compared with buildings that lack these sustainability aspects.

The Intergovernmental Panel on Climate Change (2007) report projects that the global temperature of the planet’s atmosphere will likely increase 1.1°C–6.4°C by the end of this century, relative to 1980–1999 baseline data. At the same time, temperature rises are linked to changes in precipitation patterns and an increase in the incidence and severity of extreme events (e.g., hurricanes, tornadoes, severe draughts, and floods). There has been a significant amount of research on city and community planning for climate change (e.g., Blakely, 2007; International Union for Conservation of Nature and Natural Resources, 2010).

The ability of a building to withstand changes in temperature and severe weather conditions while maintaining the safety and comfort of the occupants is an important sustainability aspect for many building owners and tenants. Buildings without the ability to withstand these conditions may be vulnerable to obsolescence, are inherently a higher risk, and may require retrofitting or demolition. Buildings that have taken climate change into consideration may lead to a value premium.

Low energy costs in many countries have been an impediment to the adoption of buildings with alternative energy systems. However, as high energy costs (especially fossil fuels) are likely for the foreseeable future, energy efficiency is of paramount consideration to investors and owners because it has the potential to provide the most economic return of any sustainability aspect.

Another important energy efficiency factor, and currently only applicable for major corporations, investors, and governments, is the scoring of companies for their
sustained commitment to controlling greenhouse gas emissions, disclosing data and strategies, supporting regulatory actions, and taking practical, near-term steps to finding lasting solutions. Ceres, a coalition of 130 major investors, companies, and public interest groups, is one of the leading climate change and corporate governance rating systems. The rating of climate risk management practices is also available from government initiatives, such as the U.S. EPA’s Climate Leaders and ENERGY STAR programs. Many major public corporations have recently added paragraphs to their annual Form 10-K securities filing that address their programs for energy costs conservation. Energy conservation has grown from being the exclusive issue of corporate profitability, to embracing global climate change, climate risk, and sound corporate governance. For an increasing number of major corporations, a corporate presence in a green building is mandatory for consistency with corporate governance policies and energy commitments.

Energy costs have risen significantly and this will impact tenants with a division of expenses between the landlord and the tenant, landlords with leases on a gross basis, and eventually base rents where energy costs are the responsibility of the landlord. It follows that a sustainability rating or energy labeling for buildings will increasingly be a consideration for tenants and may hasten the renovation of buildings that are less energy efficient. The appraiser is cautioned to compare buildings with similar energy efficiency systems/ratings in the selection of comparable sales, rentals, and financial characteristics.

As important as energy efficiency is in the description of a building’s sustainability characteristics, the appraiser should also consider the source of energy used within a building. The relevant energy issues are whether it is from a carbon-free source (e.g., wind, solar, ground source heat pumps) or not, and whether the energy source is secure in terms of continuity.

For buildings with a whole or partial carbon-free energy source, the appraiser should consider whether the technology of the building’s generation system is or is not sufficiently developed to result in a benefit from installation over the typical life of the building. If not, a capital cost for its updating or replacement may be applicable.

Even in North America where water has been both plentiful and cheap, society is increasingly coming to see it as a scarce and depleting resource. At least 36 states are expected to face water shortages within the next five years with results that include rising temperatures causing increased evaporation; loss of high-altitude snowpack that supplies a significant amount of water in the West; rising sea levels causing saltwater infiltration of freshwater aquifers in coastal states; shrinking water levels in the Great Lakes; and population increases and increasing water consumption.

Water is rapidly becoming a target for conservation due to projected shortages, increasing cost, and corporate social responsibility (CSR) policies. In commercial buildings where the majority of water consumption is not for drinking purposes, the relevant building characteristics may include a variety of equipment designed to reduce water consumption, such as the use of “gray water” for
landscaped areas and flush toilets, waterless urinals, and rainwater collection and redistribution systems.

Landscaping for sustainability will utilize drought resistant and perennial groundcovers that require minimal water, chemicals, and fertilizers to survive. Effective use of trees has the potential to significantly reduce air-conditioning costs by reducing light penetration and reducing heating costs when used as windbreaks while shrubs and ground cover reduce temperature due to absorption, evaporation, and radiation control.

With rising landfill costs, escalating diesel fuel prices, and increasing regulatory pressure, waste management is becoming a significant cost issue for income-producing properties. There are many potential waste streams in our income-producing properties that can be valuable resources for energy and reduced operating costs. These include food processing waste, waste plastic, and municipal wastes destined for landfills. A centrally-controlled recycling system of a building with convenient access and storage is increasingly an important sustainability metric in determining its sustainability performance.

**Location Analysis.** The location analysis can consider its accessibility, contextual fit, and the impact of the site improvements on the subject site. In order to be consistent with sustainability issues, the building may be accessible via a range of public and mass transportation for people and materials or more fuel-efficient or convenient transportation alternatives.

The contextual fit, referring to the sustainability-apppropriateness of a building within its location, can be described as having (1) a catalyst or “halo” effect with a positive impact on values on its locality; (2) an “echo” effect where “the existence of the building itself leads to an increase in values in the area which rebounds on the subject property;” and (3) a negative effect where the subject building deters social and business activity in the area with a negative impact on values (Ellison and Sayce, 2006, p. 301).

The location of the building and its site development can positively or negatively impact the ecosystem. Relevant to the appraiser are ecosystem characteristics that might have an impact on the economic performance of a property. Examples of ecosystem impacts on the value of the property might include atypical site development costs, issues that have regulatory or remediation impacts/costs, setbacks from water courses, flooding, and rising sea levels.

**Regulation, Tax, and Financial Incentives.** The federal government and many state and local governments have decided to require or encourage more environmentally-friendly building policies. A wide variety of different approaches are utilized to accomplish these policy objectives including statutes, ordinances, and regulations that compel and/or incentivize green building initiatives. In some cases the government will develop its own building or development standards and others may select standards that have been developed by an independent third-party organization (e.g., LEED, Green Globes).

Many of these factors can impact value and should be considered in the comparable analysis. The appraiser should be aware of incentives such as grants,
loans and taxes, planning incentives (e.g., expedited review, permit fee waivers, density bonuses, reductions in parking space requirements), and credits from validated and registered carbon emissions reductions.\textsuperscript{14}

Similarly, the appraiser should consider whether state and local governments utilize negative incentives (e.g., construction waste disposal fees, taxes levied on unsustainable aspects of buildings, greenhouse gas emission fees\textsuperscript{15}) to discourage low performance projects and practices.

In this complex and constantly changing arena, appraisers are cautioned to rely on other experts with specialized knowledge.\textsuperscript{16}

When an appraiser is providing a value-in-use estimate, investment analysis, or in a consulting assignment, the individual should consider the developing field of “green mortgaging,” which may provide a lower lending rate for green development.

**Green Leases.** For an income-producing property, the lease is an appraiser’s key element in the projected performance of a building. The lease defines the contractual relationship between the landlord and tenants (e.g., who does/pays what, when, how). For appraisers’ familiar with the typical commercial lease, they will find a number of new issues to consider in an analysis of a green lease.

For the appraiser who typically reads the lease, presumes typical property management, and inputs the lease terms into Argus Valuation–DCF\textsuperscript{TM} or similar software, the analysis of an income-producing property with sustainability characteristics requires a deeper level of analysis. A green lease, although there is no widely-accepted definition, is a lease that requires both the landlord and tenant to act responsibly in terms of the conservation of resources and efficient use of materials and resources while maintaining a healthy and productive interior environment. Model green leases have been developed by BOMA International (http://www.boma.org), the Corporate Realty Design & Management Institute (http://www.squarefootage.net), the Open Standards Consortium for Real Estate (http://www.oscre.org), and the Real Property Association of Canada (http://www.realpac.ca). Appraisers are advised to view these green leases so as to be able to compare these models with the green lease at a subject property.

A green lease may have an impact on cash flow in the case of reserves for replacement, tenant improvements, maintenance and refurbishing to sustainability standards. Absence of a green lease and/or failure to adequately maintain the attributes designed to improve sustainability performance may harm the building performance, increase capital costs and/or operating costs, and may impact insurance. Its absence may also cause sustainable certification to be lost, thereby losing the attributes that attracted the tenants, causing increased vacancy, tenant turnover, marketing, tenant concessions, and reduced rent.

Whitson (2010) offers the five building operating issues below and explains how a green lease differs from a non-green lease:

1. **Energy:** A typical non-green lease for a multi-tenant office building is likely a net lease where there is a pro-rata share allocation of the operating
costs. This type of lease provides no method for the tenant to see any economic benefit from reducing energy consumption. In one type of an effective green lease, the landlord is responsible for all energy costs up to a stated allowance and, with the use of sub-meters for tracking each tenant’s energy use, any energy usage over the allowance is billed to the tenant as additional rent. With shared incentives, the owner can lower operating costs and improve return through continued high efficiency. Tenants are encouraged to manage their energy consumption (e.g., through controlling after-hours energy use).

2. Operating Performance: Mendell et al. (2006) found that the most important health complaints in office buildings were excessive building moisture, inadequate outdoor air, excessive dust, pollutant gases and odors, inadequate thermal control, and inadequate attention by management to indoor environments. These issues may be addressed in a non-green lease and refer to general terms such as “reasonable” or “comparable” to other buildings of the same class in the area. A green lease should state that the building’s indoor air quality will comply with ANSI/ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy and ANSI/ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality. The purpose of these standards is to specify minimum temperature and ventilation rates and other measures that are “acceptable to human occupants and that minimize adverse health effects” (Standard 62.1-2010, p. 1). It is also suggested that the lease should state the operational limits (e.g., temperature, humidity) of the IAQ systems.

3. Recycling, Daytime and Green Cleaning, Green Pest Management: Most often not addressed in a non-green lease but a requirement for one, these clauses will address operating performance standards as they relate to cleaning and maintenance activities (including green cleaning procedures, sustainable cleaning products, hardscape and landscape maintenance, integrated pest management, and waste management). The USGBC framework maximizes operational efficiency while minimizing environmental impacts of buildings in LEED for Existing Buildings Operations and Maintenance. Appraisers should be generally familiar with its contents in order to assess the subject’s operating standards (http://www.usgbc.org/DisplayPage.aspx?CMSPageID=221).

4. Annual Environmental Performance Report: A green lease will include an annual environmental performance report by and for tenants and owners on such issues as operating hours, energy use, renewable energy, water use, and recycling. This is indicative of a performance-based property management approach to guide their planning, maintenance, operations, and contracting practice to maximize property sustainability. Many corporations now require their supply chain to provide annual environmental performance reports.

In March 2010 the Open Standards Consortium for Real Estate (http://www.oscre.org), a consortium to facilitate collaboration on standardized data exchange, developed core lease abstract data for green leases to
enhance environmental and sustainability reporting. This document is available for public use and will make the collection, analysis, and reporting of information for the landlord and tenants more transparent and cost effective.

5. **Interior Construction:** The use of sustainable building materials can provide reduced maintenance/replacement costs over the life of the building, energy conservation, improved occupant health and productivity, lower costs associated with changing space configurations, and greater design flexibility. Therefore, the material/product selection for the initial fit-out of tenant space and subsequent tenant improvements must also be consistent with resource efficiency (e.g., recycled or renewable content, durable, locally available), indoor air quality (e.g., minimal VOCs, moisture resistant), energy efficiency, water conservation, and affordability. Both the Tenant Work Letter Agreement and the Contractor Regulations should address the sustainable product requirements and the construction practices.

The appraiser should consider the elements of the LEED for Commercial Interiors certification, which provides a checklist of sustainability elements that can be utilized for the analysis of the subject property and comparables (http://www.usgbc.org/DisplayPage.aspx?CMSPageID=145).

**Comparable Property Data**

Paralleling the description of the subject property to the greatest degree possible, the comparable property data will address the sustainability characteristics of the comparable properties (e.g., improved sales, rentals) including building certification, analysis of the land use/site, building design characteristics, the building materials, a location analysis, impacts of any regulatory, taxation or financial incentives, and relevant elements of the green leases.

**Step 4: Data Analysis**

**Market Analysis**

Of particular relevance for a subject property with sustainability aspects is capturing the characteristics of the market area that impact supply (e.g., availability of similar properties, government initiatives/incentives), demand (e.g., movement of corporations into the area with strong CSR goals, market sensitivity to sustainability), and marketability.

**Highest and Best Use Analysis**

The most significant difference between the highest and best use analysis for a property with sustainability aspects and one without is the test of financial feasibility. The appraiser may find that the market area does not support a building with a high level of sustainability attributes (i.e., a higher cost) and only recognizes
energy efficiency (a marginally higher cost than one with a lower level of energy efficiency). The appraiser’s market analysis, sales comparables, rent comparables, and DCF input variables will all be factors to consider in the financial feasibility analysis, the final opinion of maximal productivity, and the conclusion of highest and best use.

**Step 5: Site Value Opinion**

The most significant differences between the data, analysis, and final site value opinion for property that will have, or has been developed with sustainability aspects, and one without, may include site characteristics (inherent features such as water, shade, natural view amenity, wind-flow patterns) and atypical site development costs (e.g., soil subsidence, contamination).

**Step 6: Application of the Approaches to Value**

There is general agreement among the sustainability and valuation literature (e.g., Guidry, 2004; Corps, 2008; Royal Institution of Chartered Surveyors, 2009; Warren-Myers and Reed, 2010; Lorenz and Lützkendorf, 2011) that appraisers should consider a number of sustainability issues. The technical and functional characteristics of the sustainable subject property must be described, evaluated, and quantified. These characteristics have a positive impact on market value within many markets (Robinson, 2005; Bowman and Wills, 2008; Miller, Spivey and Florance, 2008; Eichholtz, Kok, and Quigley, 2009, 2010; Miller, 2010).

A rental and sale price premium for buildings with a green label or certification has been indicated (e.g., Miller, Spivey and Florance, 2008; Miller, 2010). Therefore, market data should be considered to determine whether there is market support for a value premium for these buildings or a value discount for buildings without these aspects.

User comfort, occupant performance, and positive health aspects of sustainable building materials and designs may have an impact on marketing time and costs, absorption period, market rent, the selection of what constitutes a competitive property, tenant renewal, cost of tenant refit, and marketability (e.g., Abbaszadeh, Zagreus, Lehrer, and Huizenga, 2006). A Royal Institution of Chartered Surveyors (2005, p. 5) case study states that “perhaps the largest single area of value from green buildings lies in the ‘soft’ gains that can be difficult to value with conventional accounting methods.”

Sustainability issues such as biodiversity preservation, environmental impact and cultural quality may enhance the reputation of the building, building owner or occupants (e.g., Green Building Council Australia, 2008). Although the impacts on property prices have yet to be isolated, they may also have an impact on marketing time and costs, absorption period, market rent, the selection of what constitutes a competitive property, tenant renewal, cost of tenant refit, and marketability.
The extent to which sustainability aspects are reflected in value estimates appears to be highly dependent on local and regional market conditions and the preferences of market participants. The view of Lorenz and Lützkendorf (2011, p. 654) (and supported by this paper) is that “sustainability issues play a role in any valuation assignment, including the valuation of conventional buildings, because such buildings are already associated with higher risks (e.g., faster obsolescence and shorter remaining economic lifespan) which must be considered and priced today.”

There is also general agreement among the sustainability literature and guidance to appraisers (e.g., Green Building Council Australia, 2008; Lorenz and Lützkendorf, 2011) that the preferred method for integrating sustainability aspects into the appraisal process is by adjusting single valuation parameters (e.g., market rent, occupancy, expenses, capitalization rate). This method is preferred because it requires a cause-and-effect relationship between the building’s sustainability characteristic and the valuation-input parameter.

It is generally recommended (e.g., Lorenz and Lützkendorf, 2011, p. 653) that the appraiser include an analysis of the “sustainability-related risks and opportunities of the subject property (including the risk of changes in estimated property values) as well as to enhance the understanding of the overall valuation result and to improve the informational content that serves as a basis for decision-makers.” The appraiser can place this analysis within each of the valuation approaches where risk (market risk, financial, capital market, inflation, liquidity/marketability, environmental, legislative, and management) adjustments are derived/applied.

**Sales Comparison**

The availability of comparable properties will vary significantly with the property type and market area. This approach is reliable when there are a sufficient number of comparable sales and when the sustainability characteristics of these properties are similar to the subject property. Comparable sales may be very difficult to find in some markets. However, in “some markets, especially with municipally sponsored programs, it will be relatively easy to find comparable properties and the sales comparison approach can be applied with a great deal of reliability” (Guidry, 2004, p. 64).

Even in markets where there are comparable sales, the difficulty remains in identifying the physical characteristics, sustainability attributes, and sustainability performance of the comparable sales. For this information, the appraiser must go well beyond the typical factors (e.g., arm’s length transaction) within the sale verification process. The appraiser must research energy certificates, interview the property manager or owner (and possibly tenants), building architect and/or general contractor, and review building files. If the appraiser determines that there is sufficient data to apply the sales comparison approach, for a property with sustainability aspects, the appraiser should consider, at a minimum, the following adjustments to the comparable sales: (1) higher comparable sale prices for sustainable buildings; (2) lower comparable sale prices for conventional buildings; (3) building certification; (4) lower/higher operating costs; (5) lower/higher replacement costs; (6) market participants’ preferences/image/reputation/
competitiveness/marketability; and (7) longer/shorter remaining economic life. Many of the DCF variables discussed above also applicable in the sales comparison analysis.

In the absence of sufficient comparable sales to provide market-derived support for an adjustment that the appraiser considers necessary in order to reflect the typical actions of market participants, it is suggested that the appraiser explains the lack of data to support the estimated adjustment. The appraiser should also provide a sub-analysis support (e.g., similar property type beyond the subject’s market area, market area conditions, interviews of market participants) for the adjustment. The appraiser should provide sufficient information to establish a cause-and-effect relationship between sustainability-related building characteristics and the valuation adjustment factor.

**Cost**

If the appraiser determines that the cost approach is applicable to the valuation of the subject property, for a property with sustainability aspects, the appraiser might consider the following adjustments or modifications to the analysis: (1) tax incentives, grants and loans, and other incentive programs; (2) slightly higher replacement costs (e.g., Ellison and Sayce, 2006) and in some jurisdictions may require renovations to meet green standards; (3) special technical building equipment; (4) depreciation (physical deterioration and functional obsolescence may be lower for green construction due to superior construction and energy efficiency (Guidry, 2004)); and (5) remaining economic life (as regulatory building sustainability standards increase, the future economic life of the building may be compromised as upgrading expenditure becomes more expensive). Alternately, green buildings may have longer economic lives because they are built with more durable, low-maintenance materials (Guidry, 2004).

It is relevant to note that the Marshall & Swift® building cost estimation service now provides cost estimates for sustainable buildings and their components.

As in the sales comparison approach, when adjustments are applied, the appraiser should provide sufficient information to establish a cause-and-effect relationship between sustainability-related building characteristics and the cost adjustment factor.

**Income Capitalization**

*Sustainability Valuation Inputs for DCF.* Consideration of sustainability aspects can be applied within the income approach. The discounted cash flow (DCF) method is addressed in this paper as the valuation-input parameters are explicit in this approach, whereas in direct capitalization, where they are largely implicit, the analysis fails to capture the detailed sustainability-related income, expenses, and risks. In the DCF analysis, the main valuation-input variables are the risk premium in the capitalization and/or discount rates, and the variables in the cash flow. Lorenz and Lützkendorf (2011) provide “a simplified overview of the composition of these two main valuation-input variables for the valuation of both conventional and sustainable buildings” (see Exhibit 2).
The two main valuation-input variables of risk premium and cash flow depend upon numerous sub-analyses including the sustainable building features, the risk avoidance characteristics of the property that may exist because of its sustainability characteristics, and the risks due to location, the subject’s features, and the market. Exhibit 3 indicates some of the factors that link to the appraiser’s cash flow and risk projections.

The DCF input variables for a property with sustainability aspects include many of the same inputs as a conventional building. However, the data, analysis, and final inputs must be based upon a market-derived analysis of comparable sales and rentals of sustainable buildings with similar highest and best use, income-expense ratios, future expectations of value changes over the projected holding period, risk characteristics, and other factors as determined by the appraiser. This list of must-haves for the ideal comparable and market-derived input variables is most appropriate for the classroom, although seldom within the reality of the appraisal office. “It is likely that for the foreseeable future, quantitative analyses of data and information on comparable properties will indicate a numerical range for each valuation-input variable, and that the practitioner’s qualitative judgment will ultimately determine the final value of key input parameters” (Lorenz and Lützkendorf, 2011, p. 659).

For a property with sustainability aspects, the appraiser should consider the following input variables in the DCF: potential gross income, vacancy and collection loss, operating expenses, terminal capitalization rate, and discount rate.
Exhibit 3 | Factors Linking Cash Flow with Risk Projections

Potential gross income may be impacted by: (1) Rental growth (factors to consider include projected changes in supply/demand and changes in occupant costs such as energy cost savings which may increase the amount available for rent); (2) positive accessibility factors such as convenience to walk to work, bicycles, and/or public transportation access and/or negative factors such as accessibility that restricts access to the more efficient transportation modes that may undermine productivity and compromise employee recruitment and retention (e.g., Ellison and Sayce, 2006); (3) tax incentives, grants, and loans, as well as other incentive programs; (4) image of the building; (5) building occupants with either a strong CSR reputation that may positively impact the marketability and value of the property, or a tenant with poor CSR credentials could have the opposite affect (see Ellison and Sayce, 2006); (6) building certification; (7) building design and materials (e.g., thermal, acoustic, and visual comfort as well as IAQ for a healthy building, worker productivity, worker sickness, and absenteeism) as they relate to rental rate (e.g., Boyd, 2005); (8) supply and demand for the property with sustainability aspects; (9) share of tenant expenses or other green lease elements; (10) tenant improvement costs that require sustainability characteristics; (11) space flexibility/adaptability; (12) level of functionality/fitness for the desired purpose; (13) minimization of mobility/travel costs; (14) resilience against extreme events (e.g., flooding, earthquakes, heat waves); and (15) tenants attracted by energy efficiency and/or renewable energy sources.

Vacancy and collection loss may be impacted by any of the elements that impact PGI in addition to the quality of tenants that will be attracted to the property due to these sustainability characteristics. Additionally, this may reduce vacancy risk due to higher attractiveness of the building for the tenants for numerous reasons, including CSR objectives.

Operating expenses (OE) may be impacted by: (1) structural condition (may impact deferred maintenance and ongoing maintenance); (2) type of construction (deferred maintenance and ongoing maintenance); (3) building materials (longevity and cost of updating/replacement); (4) technical quality (longevity and capital costs and maintenance); (5) energy efficiency (cost of energy); (6) systematic and appropriate maintenance; (7) green lease (allocation of operating expenses/tenant reimbursement); (8) space flexibility (tenant improvement costs); (9) contamination (remediation or ongoing monitoring costs); and (10) locational risks (resilience against extreme events such as flooding).

Terminal capitalization rate may be impacted by: (1) market’s perceived future risk for sustainable buildings with the subject’s characteristics; (2) market expectations of future supply/demand for sustainable buildings; (3) expectations of income and value changes over a typical holding period; and (4) market expectations regarding economic life and obsolescence.

The discount rate may be impacted by locational, property-specific, and market risks, including, but not limited to: (1) locational risks due to soil stability/contamination, changes in market area quality/desirability, and changing climactic conditions; (2) property-specific risks due to structural condition, type of construction, building materials (lower risk of losing a tenant and environmental
litigation), durability and resilience of building, changes in market preferences (quality, attractiveness), image and potential changes to image/marketability, ability to meet market rental expectations, and ability to meet market yield expectations; and (3) market risks due to real estate conditions and projections for the subject property type; economic conditions and projections (e.g., competing asset classes are likely affected by sustainability and may have an indirect impact on the cost of capital); political, legal, and private sector policy, conditions, and projections (possibly as a response to issues such as energy costs, resource depletion, and climate change); certainty of future cash flows; and probability of acts/events beyond control. Exhibit 3 captures many of the elements of cash flow and risk for a property with sustainability aspects.

**Sensitivity Analysis.** As an additional section, typically within the income approach, a sensitivity analysis/Monte Carlo simulations are recommended to show the impacts of changing factors such as market conditions and uncertainties (e.g., French and Gabrielli, 2004, 2005; Lorenz, 2006; Bowman and Wills, 2008; Green Building Council Australia, 2008; Lorenz and Lützkendorf, 2011). Appraisers are typically familiar with applying a sensitivity analysis in a DCF analysis. This might involve minor variations in various inputs such as rental income, operating expenses, tenant roll-over percentage, terminal capitalization rate, and discount rate.

However, buildings with sustainability aspects have the potential for different and more complex changing future conditions, such as political, technical, and economic risks that are not well accounted for in standard valuation methods. A Monte Carlo simulation method can address these risks, and any other future uncertainty or risk. This section of the appraisal report should clearly explain the cause(s) of the sustainability-related risks or uncertainty, any abnormal uncertainty, and the degree of uncertainty, including the risk of changes in the value estimate(s). However, Monte Carlo simulations are not currently part of the typical educational programs for appraisers in North America. Acquiring this skill set may be well-advised for the appraiser valuing larger or more complex sustainability projects. Appraisers new to Monte Carlo simulations are referred to Hoesli, Jani, and Bender (2006), Barreto and Howland (2010), and Rode, Fischbeck, and Dean (2001). There are a number of Monte Carlo software packages, including @Risk software by Palisade Corporation and GoldSim from GoldSim Technology Group.

**Hedonic Pricing.** In an attempt to integrate aspects of energy efficiency into income-property valuation methods, numerous researchers have applied multiple regression analysis in the framework of hedonic pricing models to empirically establish the effects of energy-efficiency characteristics on property values. Robinson (2005), Bowman and Wills (2008), Miller, Spivey, and Florance (2008), Eichholtz, Kok, and Quigley (2009), and Miller (2010) suggest that sustainability aspects have a positive impact on market value. In contrast, Leopoldsberger, Bienert, Brunauer, Bobsin, and Schützenhofer (2011) suggest that the market does recognize energy efficiency as a value-influencing factor of buildings with sustainability aspects.
The above studies, however, all use hedonic modeling to integrate aspects of energy efficiency into income-property valuation approaches. Leopoldsberger, Bienert, Brunauer, Bobsin, and Schützenhofer (2011, p. 124) suggest: “One should note when examining the analysis illustrated and explained that such advanced interpretation methods to derive valuation input parameters fall well beyond the scope of standard valuation practices as (1) they require a huge sample of comparable property information not usually available to valuers, and (2) they can only be performed with advanced statistical knowledge. Therefore, it is unlikely that valuers could extract statistically significant results even if they could carry out such analysis in practice.”

**Survey Research.** As previously stated, while the ideal would be “revealed preference” data (sales or executed leases) to support the adjustments in the sales comparison approach and the valuation-input variables in the DCF, it is likely the practitioner’s qualitative judgment will ultimately determine the final value of key inputs (Lorenz and Lützkendorf, 2011). However, it is incumbent upon the appraiser to go beyond an exclusive reliance on a “practitioner’s qualitative judgment” in order to comply with the USPAP’s Competence Rule and to excel in real property litigation settings.

Gordon (1988, p. 259) states that “Most appraisers now come to realize that all value estimates are economic forecasts that attempt to simulate the thinking of knowledgeable market participants.” And, according to Allen and Austin (2001, p. 395), Appraisers have only two ways to predict the choices or transactional values of buyers and sellers. The first way is estimates that are inferred from observed actions such as the sale of comparable properties. This approach, derived from early valuation theory economists, has a strong bias in favor of transactional data. The second way is preferences, anticipations, beliefs and attitudes of knowledgeable market participants. These are measured by market survey techniques.

There is a debate in the literature on an appraiser’s use of formal survey research in determining a value estimate. The debate typically surrounds the use of a quantitative diminution in value, such as the damage due to contamination, as measured by the contingent valuation method [see the literature review by Throupe (2011)]. However, there is agreement that surveys can be used as a secondary or support role for valuation (e.g., McLean and Mundy, 1998; Roddewig, 1999; Bell, 2008). For example, Flynn, MacGregor, Hunsperger, Mertz, and Johnson (2004) utilized a survey to show a causal link between an environmental disamenity and the loss in market value, not to measure market value itself. This type of survey design and use would be consistent with showing a causal link between a property’s sustainability aspect(s) and positive perceptions of the market participants, upward adjustment(s) applied by the appraiser, and increase in market value. This causal link would go a long way towards supporting the appraiser’s estimates of adjustments and value-influencing variables. Further, this “causal link is critical in litigation where the valuation measurement is not enough, and appraisers are asked to support the causality link for their opinions” (Throupe, 2011, p. 303).
Step 7: Reconciliation of Value Indications and Final Opinion of Value

The purpose of the reconciliation section of the appraisal report for a property with sustainability aspects is no different than any other property. According to The Appraisal of Real Estate (2008), the purpose of the final reconciliation process is to resolve the differences among various value indications, to reveal conflicts or unresolved questions, to provide a quality control assessment of the valuation process, and to identify key factors that should be cited and explained, or elaborated upon, within the appraisal report. However, for the property with sustainability aspects, the questions asked in reconciling value indications may be slightly different than for a conventional or traditional subject property. For the convenience of the reader, the reconciliation questions in The Appraisal of Real Estate (2008, p. 560) are repeated below, with additional questions for a sustainable subject property, if applicable, in italic font.

The Sales Comparison Approach

1. Are there an adequate number of sales?
2. Are the sales comparable?
   a. Does the market differentiate in terms of tenant or investor demand between a property with sustainability aspects and one without?
   b. Does the market differentiate in terms of tenant or investor cost savings, or the life cycle or market value between a property with sustainability aspects and one without?
   c. To what extent do the building’s sustainability features compare with the comparables?
   d. Is there green certification, and is it valued by buyers and/or tenants in the market?
   e. Are there trends in tenant occupant needs/requirements that will impact marketability?
   f. Are the characteristics of the subject and comparables connected with their position on sustainability issues or their CSR criteria?
   g. Are the subject and comparables impacted by sustainability regulations, tax incentives or other issues that impact rent and/or value?
3. Are there prior sales of the subject property that need to be analyzed?
4. Is there market support for the adjustments that were made?
5. Were those factors that could not be supported by quantitative adjustment dealt with adequately using qualitative analysis in the reconciliation?
6. Is the range of adjusted sale or unit prices within the range exhibited in the market?
7. Are the conclusions of the approach consistent with the conclusions in the other approaches?
Land Valuation

1. Are there an adequate number of sales?
2. Are the sales comparable?
   a. Do the comparables reflect similar sustainability characteristics such as accessibility, contextual fit, and site-specific ecosystem?
3. Is there market support for the adjustments that were made?
4. Were those factors that could not be supported by quantitative adjustment dealt with adequately using qualitative analysis in the reconciliation?
5. Is the range of adjusted sale or unit prices within the range exhibited in the market?

The Cost Approach

1. Is the land value well supported?
2. Are the cost estimates reliable and market-based?
3. Do the cost estimates account for all of the costs?
4. Are renovations required to meet some green standard?
5. Are the sales used to extract depreciation from the market reliable?
6. Were physical, functional, and external depreciation estimated accurately?
   a. Can any sustainability deficiencies be rectified by retrofitting or are there barriers due to building characteristics or financial feasibility?
   b. Is the building made more or less susceptible to depreciation and obsolescence by reason of its sustainability aspects?
7. Are the conclusions of the approach consistent with the conclusions reached in the other approaches?

The Income Capitalization Approach

1. Is there an adequate number of rental comparables?
2. Are the rental properties comparable?
   a. Does the market differentiate in terms of tenant or investor demand between a property with sustainability aspects and one without? If so, do they add realizable value and is this a temporary or longer-term benefit?
   b. Does the market differentiate in terms of tenant or investor cost savings, or the life cycle or market value between a property with sustainability aspects and one without?
   c. To what extent are the building’s sustainability features reflected in the comparables?
   d. Is there green certification, and is it valued by tenants in the market?
   e. Are the subject and comparables impacted by sustainability regulations, tax incentives or other issues that impact rent and/or value?
3. Is there market support for the adjustments that were made?
4. Were those factors that could not be supported by quantitative adjustment dealt with adequately using qualitative analysis in the reconciliation?
   a. Was the appropriate level of explanation provided for adjustments and/or were alternate valuation methods utilized to support the adjustments?
5. Is the historical expense information available? If so, how reliable is it?
6. Do the owner’s income and expense statements include all income?
7. Do the owner’s income and expense statements include all expenses?
   a. Is the building made more or less susceptible to depreciation and obsolescence by reason of its sustainability aspects?
   b. Will the building require a greater allowance for operating expenses or capital costs due to its sustainability aspects?
8. Do the owner’s income and expense statements include any expenses that are not typical?
9. Are the expense projections in line with market estimates?
   a. Are the market’s projections for energy costs reflected in the appraiser’s projections for income reimbursements and expenses?
   b. Can any sustainability deficiencies be rectified by retrofitting or are there barriers due to building characteristics or financial feasibility?
   c. Do the sustainability aspects and internal flexibility and adaptability reduce the cost of tenant improvements and increase the probability of tenant renewal?
10. Is there market support for the capitalization method?
11. What is the impact, if any, of “green mortgaging” which may provide a lower lending rate for green development?
12. Is there market support for the capitalization or discount rate?
   a. Does the market recognize less risk for buildings with good sustainability characteristics due to greater demand and therefore a lower investment risk?
   b. Does the increasing awareness of sustainability issues and the movement for carbon reduction have an impact on purchase decisions and investment yield?
   c. Have all the sustainability aspects that could potentially impact PGI, VCL, OE, risks, capitalization and discount rates (stated within this paper) been considered?
13. Does the method of capitalizing income reflect market patterns?
14. Are the conclusions of the approach consistent with the conclusions in the other approaches?
   a. Does the valuation consider, explain and reflect all material factors that may influence value?

*The Appraisal of Real Estate* (2008, p. 560) states that the final “reconciliation relies on the proper application of appraisal techniques and the appraiser’s
Sustainability and Income-Producing Property Valuation

This statement is highly applicable to the current status of appraising income-producing properties with sustainability aspects. Lorenz and Lützkendorf (2011, p. 659) state: “In valuation practice [...] it is rare for an individual practitioner to possess significant data on comparable properties that would enable quantitative analyses to directly and precisely determine appropriate valuation-input parameters for the valuation of a particular property. It is likely that for the foreseeable future, quantitative analyses of data and information on comparable properties will indicate a numerical range for each valuation-input variable, and that the practitioner’s qualitative judgment will ultimately determine the final value of key input parameters.” Consistent with the reconciliation criteria in The Appraisal of Real Estate (2008), the appraiser will consider the appropriateness, accuracy, and quantity of evidence in the development of a final opinion of value that is meaningful and defensible.

Step 8: Report of Defined Value

The reporting of the final opinion of value is unchanged for a property with sustainability aspects and one that lacks these characteristics.

Conclusion

In this paper, by following the “valuation process” promulgated by the Appraisal Institute, appraisers and consumers of appraisal services are provided with a roadmap to the appraisal of income-producing properties with sustainability considerations. While it is clear that a sustainable property is not an entirely new property type and does not yet possess criteria that call for a deviation from the traditional valuation methods, it creates many new factors to be researched and addressed by appraisers, and considered by consumers of appraisal valuation and appraisal consulting services.

Over time, appraisers will encounter an increasing number of sustainable buildings, sufficient data to derive value-input variables, and an increasing number of appraisal assignments for sustainable properties. Through this evolution, the appraiser’s sustainability education will grow in depth and complexity. However, until that time, appraisers and consumers of appraisal services are cautioned to:

1. Consider, with a limited number of opportunities to have worked on appraisals of buildings with sustainable aspects and the limited number of course offerings that address the unique property characteristics and valuation issues, whether the report is prepared in compliance with USPAP’s Competency Rule.
2. Consider modifying the client contract to parallel the intended scope of work, reliance on the opinions of other professionals, extraordinary assumptions, and other relevant factors that may impact the appraisal report and its credibility.
3. Rely on other professional reports for areas impacted by sustainability characteristics that are outside the appraiser’s expertise.
4. Expand the scope of work to fully integrate sustainability aspects into the valuation process.

5. Go beyond the typical scope of research for comparable sustainable rentals and/or sales in order to understand all of the property characteristics and preferences of market participants.

6. Conduct a sub-analysis to be able to provide the client with a cause-and-effect relationship between sustainability-related building characteristics and the valuation adjustment factor.

7. Avoid generalizing the results of sustainability study results (e.g., assertions that certified buildings command a value premium over those that are not certified), across property types, market areas, and market conditions.

**Appendix**

**Towards an Interdisciplinary Language for Sustainable-Development Professionals**

**Literacy Elements for Sustainable-Development Professionals**

Literacy Elements for Sustainable-Development Professionals is a consensus opinion on the basic multidisciplinary, sustainable-development knowledge needed for individuals working and teaching in professional specialties of architecture, land-use planning, landscape architecture, engineering, real property valuation, accounting, and law.

These Literacy Elements provide a vision for the future to help such professionals and others gain a better understanding of sustainable development, around which the following questions and answers have been compiled.

Q1: Why do we need Literacy Elements for Sustainable-Development Professionals?

A: Literacy Elements for Sustainable-Development Professionals provides focus, direction, and coherence to the highly complex disciplines of sustainable development. Literacy Elements are needed because:

- Professional specialization hinders the ability to think broadly and across boundaries. Sustainability issues are too broad and complex to be dealt with in a compartmentalized professional or academic fashion. They require a holistic approach, as well as interdisciplinary knowledge and skills in order to solve complex, interrelated, and multi-dimensional problems.

- A professional population sharing a “common understanding” or “common language” of sustainable development will enhance individual and interdisciplinary professional communication, competence, and hasten global sustainability.
Q2: Why do we need Literacy Elements for professionals when many existing education programs address sustainability?
A: University-based and professionally targeted programs provide some opportunities for the acquisition of expert sustainable-development insights (e.g., daylighting for architects, protecting bio-regions for land-use planners, inter alia). However, Literacy Elements address an extensive body of knowledge of the origins of sustainable development, its interdisciplinary and complex features, innovative strategies, as well as the integration of science, humanities, and social sciences for each project in which the professional/academic is involved.

Q3: Who is developing the Literacy Elements and why?
A: The Institute of Green Professionals (IGP) with the help of academics, professionals, NGOs, governments, and professional societies in every discipline are currently involved in developing the Literacy Elements. These Literacy Elements and Knowledge Components may be used or modified to develop academic and professional courses and to underpin professional standards. IGP will use the Literacy Elements and Knowledge Components to develop its free open-access course entitled: “General Comprehensive Course: Sustainable-Development Literacy for Professionals.”

Q4: What are the Literacy Elements?
A: There are two broadly-based Literacy Elements:
1. Understanding interdisciplinary and complex conceptual frameworks, models, theories, terms, and methods for sustainable development.
2. Thinking in a holistic way about sustainable development problems and having the knowledge and vision to recognize that interdisciplinary approaches are necessary to solve problems dictated by the innate complexity and interconnectedness of social, economic, and ecological systems.

Q5: How are the Literacy Elements operationalized?
A: The two broadly stated Literacy Elements are operationalized by a list of Knowledge Components. These Components will provide individuals with the “common language” or communication tools and general knowledge to facilitate interdisciplinary communication. They are the specific theories, concepts, issues, and terms that form the “common language” basis of understanding sustainable development. (See Appendix A for the Knowledge Components.)

Q6: Is this an attempt to delineate knowledge boundaries into a reductive agenda inconsistent with the complexity and interdisciplinary characteristics of sustainable development?
A: No. The professionals and academics for these Literacy Elements have a dominant role to play in creating more sustainable forms of economic development, environmental protection, and social equity. These
Elements are a first step towards improving sustainable-development outcomes by providing such individuals with a “common language of sustainability.” They are neither designed to abandon specialized technical knowledge, nor to place limits on knowledge. Rather, they provide a common language for sustainability professionals and academics to identify potential linkages, strategic collaborations, and understand the interrelationships between different sustainable strategies to create effective sustainable development and sustainable-development education.

Q7: Are these Literacy Elements and the Knowledge Components intended to be more than a generalist’s introduction to sustainable development?

A: No. Short of a PhD in sustainable development, there are few academic programs that would produce an “expert” or graduate in the subject. These Elements and Components are intended to introduce the knowledge that forms the basis for the sustainable-development professional and educator.

Q8: Why are the proposed standards referred to as “Literacy Elements” rather than “standards”?

A: Literacy Elements and their Knowledge Components are not formal “standards” with auditable requirements as in the International Organization for Standardization (ISO) 14000 family for environmental management. They are referred to as Elements/Knowledge because they are a model or example of what forms the basis of a “common language” for sustainable development professionals and academics as established by consensus.

Q9: Do the Literacy Elements and their Knowledge Components comprise a curriculum?

A: No. It is anticipated that educators and professional organizations would use the Literacy Elements and the Knowledge Components to develop their own curriculums and assessment techniques, as well as the other components of an overall curriculum plan. However, at the postgraduate level in a profession where learning is based on professional practice, individuals would construct their own version of the curriculum according to the dictates of specific projects or enterprises.

Appendix A

Knowledge Components

The most common conceptual framework for sustainable development (SD) is the Three E model of Economic, Environment, and Social. This is also referred to as the Triple Bottom Line (or people, planet, profit).
We recognize that the Three E model will become dated. A more complete model than those previously existing has already been developed by Jabareen (2003) in: “A new conceptual framework for sustainable development.” However, for the time being, this model remains consistent with the predominant Three E conceptual framework, the existing language in most organizations, and our focus in this consensus document on built-environment professionals and educators.

The Knowledge Components are organized by first stating the conceptual framework (economic, environment, social), describing the heading(s) within the framework, followed by the relevant theories, concepts, issues, and terms.

Special Notes to Reviewers: This list can expand à la Malthus; however, the focus is on what is most applicable for sustainability professionals. If you make a suggestion for a new topic, please provide a web link or full citation to a relevant paper that is available online, a web-based lecture/presentation, or book.

1. Economic: This concept is organized under the headings of (a) integrative management and (b) eco-form.

(a) Integrative Management: This concept represents SD’s view that social development, economic growth, and environmental protection are to be holistically integrated in order to achieve SD. The integrative approach argues that the responsibility for bringing about changes lies with governments in partnership with the private sector, educational institutions, in collaboration with national, regional and international organizations. In addition, national plans, goals and objectives, national rules, regulations and law, and the specific situations whereby different countries are placed are the overall framework in which such integration takes place.

Theories/Concepts/Issues/Terms
Holistic approach
UN Commission on Sustainable Development and sustainable consumption
World Business Council for Sustainable Development
Agenda 21
German Best Available Technology legislation
Waves of innovation and the next industrial revolution; closed-loop manufacturing
Precautionary principle, definition, measures and legislation
Organization for Economic Cooperation and Development policy instruments
  Polluter pays principle
  Definition of pollution and polluter
  Recent court cases
  Extended producer responsibility
Khazzoom-Brooks postulate and the rebound effect
Role of education in SD
Role of professional education in SD
Principles to guide sustainability (e.g., do no harm)
Barriers to achieving sustainability (e.g., short-terminism)
How to measure growth
Abandoning the three “canonical principles” of micro-economic theory
Patterns of consumption
Integrative SD methods for business
  Equator Principles
Integrative SD methods for consumers
Integrative SD methods for government
SD and consumer motivation
Global Reporting Initiative
Competitive advantage via innovation
Integration of environmental concerns and development in planning and management
Integrating sustainability into corporate strategy
Economic instruments as incentives
Quotas, trades, offsets and banks
Reasons economic growth is consistent with sustainable development
Emerging business opportunities
Describing the sustainable organization
Examples of industry responses to climate change
Life cycle costing and performance
Environmental accounting systems
Systems of integrated environmental and economic accounting
Social Responsibility
Example of Interface Ltd as the first sustainable corporation
Cluster development
ISO 14000 and 14001
Independent certifying of products
Multi-stakeholder engagement
Integration of Building Information Modeling and ISIS method for SD projects
(b) **Eco-Form:** This concept represents the ecologically desired form and design of the human habitat such as urban spaces, buildings, and houses so as to enhance/achieve SD.

**Theories/Concepts/Issues/Terms**
Land use
“RUrbanism” and Goa 2100 project
Mixed use development
Smart growth
Neotraditional development
Urban containment
Form-based codes
Competing geometries
Fractal “geometry of nature”
Euclidean “marks of humanity”
Water property rights and conservation
Ecology
Cultural heritage
Buildings
Reasons/benefits for change
Barriers to change
Information, market and institutional failures affecting SD
Rating schemes
Retrofitting existing buildings
Net positive development
Design
Whole system design
Elements of eco-development practice
Sustainable habitats/compact housing designs
Climate neutral buildings
Alternative building materials
Cradle-to-cradle/closed-loop system v. eco-efficiency
Biomimicry
User comfort and satisfaction
Form and space
Building Information Modeling (BIM)
Recycling and downcycling
Energy efficiency
Conservation
Eco-villages
Transportation
Sustainable transport systems
Integration of pedestrians and cyclists
Implications of behavior and cultural practices
Access
Air quality and micro-climate
User comfort and satisfaction

2. Environment: This concept is organized under the headings of (a) natural capital stock and (b) ethical paradox.

(a) Natural Capital Stock: This concept represents the natural material assets of nature including the ecosystems that support life. Natural capital includes all natural assets: humans can modify it, and humans can enhance its reproduction, but it cannot be created by humans. Natural capital stock is usually divided into three categories: (1) non-renewable resources such as mineral resources; (2) the finite capacity of the natural system to produce “renewable resources” such as food crops and water supplies; and (3) ecosystems services, the capacity of natural systems to produce the essentials for life, including photosynthetic reactions, production of oxygen, cleansing of air and water, as well as nature’s ability to absorb and eliminate the emissions and pollutants that arise from human actions without suffering from side effects. This implies heavy costs will be passed on to future generations. A constant natural capital is frequently referred to as a criterion for sustainability where resource stock should be held constant over time to avoid threatening future generations’ opportunity to create wealth and well-being.

Theories/Concepts/Issues/Terms
Global environmental issues/declining ecosystems
Economic methods of environmental valuation
GDP, cost-benefit analysis
Revealed preference, stated preference and other methods (e.g., benefits transfer)
Human capital, cultivated capital, total capital
Environmental services
Natural limits
Ecological economics v. environmental economics
Strong/weak sustainability
Current geological epoch of Anthropocene (Crutzen)
Resource productivity improvements (e.g., Bioheap in mining)
Water
   World Commission on Dams Report (2000)
   Improving water efficiencies
Energy
   Hidden costs of externalities
   Methods to reduce greenhouse emissions
   Sustainable energy methods in urban development
Land utilization
Waste
   Physical methods and economic instruments for pollution control
GEO4 Report
UN Millennium Ecosystem Reports
IPCC Reports on Climate Change

(b) **Ethical Paradox:** This concept represents the perceived ethical paradox with the combining of the words “sustainable” and “development.” At one extreme, “sustainability” is defined as an ecological process or state than can be maintained indefinitely and is ethically based upon the “intrinsic right of nature.” At the other ethical extreme, “development” modifies the land and exhausts natural resources and is ethically supported by our right to “dominate nature.” Virtually all definitions of SD recognize a tension between the goals of environmental protection and economic development.

**Theories/Concepts/Issues/Terms**
Early Environmentalism: in the words of Henry David Thoreau, John Muir, and Aldo Leopold
Modern Environmentalism 1960s and 1970s: in the words of Rachel Carson, Kenneth E. Boulding, and Garrett Hardin
Sustainability in the words of Wendell Berry, David Brower, Amory Lovins, Wes Jackson, William Cronon, E.O. Wilson, Alan Durning, Paul Hawken, and Rebecca Solnit
Concepts of sustainability and SD
   1. Carrying capacity
   2. Cultural carrying capacity
   3. Biological diversity
   4. Ecological footprint
   5. Fair share, overshoot
6. Decoupling economic growth from negative environmental pressure

7. Net positive development
   Bruntland Report (1987) and sustainable development
   Sustainable prosperity
   Common principles to achieve sustainable development

3. **Social**: This concept is organized under the two headings of (a) equity and (b) political global agenda.

   (a) **Equity**: This concept represents the social aspects of SD and the required balancing of social aspects with environmental and economic objectives in order to attain SD. It is believed that this social dimension is critical for SD since the unjust society is unlikely to be sustainable in the long term. A truly sustainable society is one in which wider social needs, equity, and economic opportunity are integrally related to environmental limits imposed by supporting ecosystems.

   **Theories/Concepts/Issues/Terms**
   - The equity principle/Brundtland Commission
   - Millennium Development Goals
   - Intragenerational equity
   - Intergenerational equity
   - Weak sustainability and strong sustainability
   - Environmental justice
   - Societal—poverty, population growth, productivity gap, health and welfare, gender issues, indigenous peoples’ rights, social benefits and costs, employment and skills, competition effects, viability, social equity, quality of life, democracy, empowerment, public participation

   (b) **Political Global Agenda**: This concept represents the new global discourse that conceives the earth as one unified community with unique cultural subregions worthy of respect and preservation. It aims to address global environmental and development problems at their root causes. It also aims to provide the people of the developing world with the tools and resources needed to equalize opportunities and enable them to address pressing problems of deforestation, climate change and loss of biodiversity; this is in addition to issues basic to survival such as population growth, disease, poverty eradication, and changing consumption and production patterns.

   **Theories/Concepts/Issues/Terms**
   - The International Bill of Human Rights (1993)
World Summit on Sustainable Development Plan of Implementation (2002)
Millennium Development Goals
Global commons
Johannesburg Declaration on Sustainable Development
Base of the pyramid (Prahalad and Hart)
Kyoto Protocol (2008)
OECD (1999) project of national systems of innovation
Agenda 21 whole society approach to sustainable development
Human rights principles
Participation principle
International law and environmental agreements
Government economic measures, actions and legislation
Key factors of SD (e.g., poverty, population, pollution)
Role of governments and new global agenda
Tragedy of the commons
Roles of self-regulation, private regulation and civil regulation
Principles of ecological economics
Ecological footprint
Economic growth vs. physical growth
Race to the bottom v. race to the top practices
North-south divide
Social Accountability Standard 8000
Microfinance institutions
Non-governmental organizations (NGOs)

Endnotes
1 The subject of this paper is being considered in Congress. On October 19, 2011, Senators Bennet (D-Colo.) and Isakson (R-Ga.) introduced the Sensible Accounting to Value Energy (“SAVE”) Act [S. 1737] to improve the accuracy of mortgage underwriting used by federal agencies by ensuring that energy costs are included in the underwriting and appraisal process. Although not likely to be adopted this election year, it indicates the growing need to include sustainability in appraisals.
2 Prum (2010) is an excellent source of the terms and definitions used to describe green buildings.
3 The Problem Identification section USPAP’s Scope of Work Rule is the source authority for these elements. See USPAP 2012–2013, p. U-13.
4 See the relevance of the Competency Rule for Fannie Mae appraisals in McCuen and Gransberg (2007).
For additional sources on a wide variety of green real estate topics (including financing), consult the outstanding Research Library and Links at the Green Building Finance Consortium at http://www.GreenBuildingFC.com.

A comprehensive explanation of the rating systems can be found in the chapter entitled “An Overview of Green Construction Rating Programs” in Feichtner et al. (2011). This book is intended for construction firms, however, is highly recommended for appraisers and other professionals involved in green construction.

Britell (2010) details terminology, real property law, liability, due process, government mandates and incentives, green building codes, zoning laws, tax credits.

Appraisers and other professionals involved in green buildings should consider the types of limitation of liability provisions to be included in their contracts (Prum and Del Percio, 2010–2011).

Substantive sections of this list have been modified from the 2009 RICS Valuation Information Paper by Ellison and Sayce (2006).

Significant growth in solar energy development has led to liability claims for shading a neighbor’s solar panels and damages for the panels reduced productivity. See Rule (2010).

For the valuation of properties with detrimental conditions, see Bell (2008).

Refer to http://en.wikipedia.org/wiki/Corporate_social_responsibility for an overview of CSR.

Recommended reading for appraisers is a comprehensive recent addition to the literature on green building regulatory structures, government requirements and incentives by Prum, Aalberts, and Del Percio (2012).

For example, Bay Area Air Quality Management District Reg. 3-334 (2009, p. 12) (adopted May 21, 2008) greenhouse gas emission fee and fees for “indirect sources” such as “development projects that generate or attract motor vehicle trips, and may also include other sources of emissions, such as fireplaces, home heating and cooling and landscape maintenance equipment, that indirectly cause air pollutant emissions and that can adversely affect local and regional air quality.”

For a basic introduction to this topic, see Circo (2009) and Kirokawa (2009).

Harrison and Seiler (2011, p. 63) found that the “political ideology of the local market area, may materially influence the market value of environmental amenities within industrial property markets.” They caution generalizing the results of green certification study results to new property types, market areas or time periods.

References


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