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Standard Practice for Building Energy Performance Assessment for a Building Involved in a Real Estate Transaction[1]

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1. Scope

1.1 *Purpose*—The purpose of this standard is to define a commercially useful practice in the United States of America for conducting a *building energy performance assessment (BEPA)* on a building involved in a *commercial real estate transaction* and subsequent reporting of the *building energy performance* information. The practice is intended to provide a methodology to the *user* for the collection, compilation, analysis, and reporting of *building energy performance* information associated with a commercial building. The practice may be used independently or as a voluntary supplement to Guide E2018 for *property condition assessments* or Practice E1527 for Phase I *environmental site assessments*. Utilization of this practice and performance of a *BEPA* is voluntary. If the property *owner* (e.g., the seller) is unwilling or unable to provide building *energy use* and cost information, a *BEPA* cannot be performed.

1.2 *Building Energy Performance*—This practice defines *building energy performance* as the building's total annual *energy use* and cost for heating, cooling, electricity, and other related uses. *Energy use*, for example, includes total electricity purchased; purchased or delivered steam, hot water, or chilled water; natural gas; fuel oil; coal; propane; biomass; or any other matter consumed as fuel and any electricity generated on site from *renewable/alternative* energy systems (for example, wind energy generator technology, fuel cells, microturbines or solar photovoltaic systems).

1.3 *Objectives*—Objectives in the development of this practice are to: *(1)* define a commercially useful practice for collecting, compiling, and analyzing *building energy performance* information associated with a building involved in a *commercial real estate transaction*; *(2)* facilitate consistency in the collection, compilation, analysis, and reporting of *building energy performance* information as may be required under building benchmarking, labeling, disclosure, or mandatory auditing regulations; *(3)* supplement as needed a *property condition assessment* conducted in accordance with Guide E2018 or an *environmental site assessment* conducted in accordance with Practice E1527; *(4)* provide that the process for *building energy performance* data collection, compilation, analysis, and reporting is consistent, transparent, practical and reasonable; and *(5)* provide an industry standard for the conduct of a *BEPA* on a building involved in a *commercial real estate transaction*, subject to existing statutes and regulations which may differ in terms of scope and practice.

1.4 *Documentation*—The scope of this practice includes data collection, compilation and reporting requirements. Documentation of all sources, records, and resources relied upon in the investigation is provided in the *report*.

1.5 *Considerations Outside the Scope*—The use of this practice is limited to the collection, compilation, and analysis of *building energy performance* information as defined by this practice. While this information may be used to facilitate building benchmarking, labeling, rating or ranking, reporting of *building energy performance* information between a seller and a buyer or a landlord and a tenant on a voluntary basis or as may be required by building benchmarking, labeling, disclosure or mandatory auditing regulations applicable to the building, or any other use, such use is beyond the scope of this practice.

1.6 *Organization of This Practice*—This practice has 13 sections and 11 appendices. The appendices are included for informational purposes only and are not part of the procedures prescribed in this practice.

Section 1	Describes the scope of the practice.
Section 2	Identifies referenced documents.
Section 3	Provides terminology pertinent to the practice.
Section 4	Discusses the significance and use of the practice.
Section 5	Discusses the relationship between this practice and ASTM E2018 or ASTM E1527.
Section 6	Describes the *user's* responsibilities under this practice.
Section 7	Describes the *BEPA* process.
Section 8	Describes the *site visit* and *walk-through*.
Section 9	Discusses *interviews* with *owner*, *operator*, or *key site manager*.
Section 10	Describes records collection for the *BEPA* process.
Section 11	Provides the records analysis methodology for building *energy use* data.

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Section 12	Focuses on *BEPA report* preparation and reporting of building *energy use* information.
Section 13	Identifies non-scope considerations.
Appendix X1	Provides the legal background on federal, state, or local building *energy use* disclosure legislation and regulation.
Appendix X2	Identifies *building energy performance* and sustainability labeling programs.
Appendix X3	Discusses government and utility energy efficiency incentives and grants.
Appendix X4	Provides guidance on suggested qualifications for the *consultant* conducting the *BEPA*.
Appendix X5	Information that can be collected from the property *owner*/*operator*/*key site manager*.
Appendix X6	Provides a recommended table of contents and report format for the *BEPA*.
Appendix X7	Provides general property types with categories and subcategories that can impact building *energy use*.
Appendix X8	Provides a general commercial building survey checklist.
Appendix X9	Presents carbon emission estimation methodology associated with combustion processes related to *energy use* in a commercial building.
Appendix X10	Provides common no-cost/low-cost energy saving measures for commercial buildings.
Appendix X11	Provides illustrative example of building *site energy use* calculations.

1.7 *Units*—The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.8 *This practice cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard practice is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this practice be applied without consideration of a building's many unique aspects. The word "standard" in the title means only that the practice has been approved through the ASTM consensus process.*

1.9 *Nothing in this practice is intended to create or imply the existence of a legal obligation for reporting of energy, performance, or other building-related information. Any consideration of whether such an obligation exists under any federal, state, local, or common law is beyond the scope of this practice.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E1527 Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process

E2018 Guide for Property Condition Assessments: Baseline Property Condition Assessment Process

2.2 *Other Standards:*[3]

ASHRAE, 2011, Procedures for Commercial Building Energy Audits

ASHRAE, 2010, Performance Measurement Protocols for Commercial Buildings

ANSI/ASHRAE Standard 105-2007 Standard Methods of Measuring, Expressing and Comparing Building Energy Performance

DSIRE Database of Federal, State, Local Government and Utility Incentives for Renewable Energy and Energy Efficiency (http://www.dsireusa.org)

3. Terminology

3.1 *Definitions*—This section provides definitions and descriptions of terms used in this practice, terms used in this practice extracted from Practice E1527 and Guide E2018, and a list of acronyms for keywords used in this practice. The terms are an integral part of this practice and are critical to an understanding of the practice and its use.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *appropriate reporting, n*—represents a standardized way to report *building energy performance* information collected in accordance with and under the specific conditions identified in this practice to parties including, but not limited to, prospective purchasers, *owner*s, property managers, lenders, tenants, investors, or others, including government or regulatory entities, that may request such information.

3.2.2 *building energy performance, n*—a building's total annual *energy use* and cost for heating, cooling, and electricity and other energy-related uses.

3.2.3 *building energy performance assessment, BEPA, n*—the process as described in this practice by which a person or entity collects, analyzes and reports on the *energy use* and energy cost associated with a building. The output from the process is the *pro forma building energy use* and the *pro forma building energy cost*, which are considered representative for the building at the time the assessment is performed. Also provided is a reasonable range for building *energy use* and energy cost. Finally, the process provides the actual building *energy use* and cost over the time period included in the investigation. A *BEPA* is based upon data collected over the prior three years, or back to the last *major renovation* if completed less than three years ago, with one year minimum. If acceptable data is not available for the minimum of one year, a *BEPA* cannot be conducted as prescribed in this standard.

3.2.4 *commercial real estate, n*—improved real property, except a dwelling or property with four or less dwelling units exclusively for residential use. The term includes, but is not limited to, improved real property used for retail, office, industrial, hospitality, agricultural, or other commercial, medical or educational purposes; property used for residential purposes that has more than four residential dwelling units; and property with four or less dwelling units for residential use when it has a commercial function, as in the operation of such dwellings for profit. (Refer to Practice E1527.)

3.2.5 *commercial real estate transaction, n*—a transfer of title to or possession of commercial real estate, rental of space in commercial real estate under a lease for a set period of time in return for consideration, a transfer of a leasehold interest in commercial real estate, or receipt of a security interest in commercial real estate, except that it does not include such transactions with respect to an individual dwelling, or a

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.

building containing four or less dwelling units, unless used for commercial purposes such as the operation of such dwellings for profit. (Refer to Practice E1527.)

3.2.6 *cooling degree-days (CDD), n*—for each day with an average temperature higher than 65°F (18.3°C), *CDD* is the difference between the average temperature and 65°F (18.3°C). For example, on a day with a mean temperature of 80°F (26.6°C), 15 *CDD* would be recorded. *CDD* data by month and region is published by the Energy Information Administration. *CDD* historical data by month and region is published by the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service Climate Prediction Center, Camp Springs, MD for 200 major weather stations around the country, and by others, including NOAA's National Climatic Data Center in Ashville, NC. Information is also available at http://www.degreedays.net.

3.2.7 *data gap, n*—lack of or inability to obtain information required by this practice despite *good faith* efforts by the person or entity seeking to gather such information. Data gaps may result from incompleteness in any of the activities required by this practice, including, but not limited to the collection of records data (for example, an inability to collect *energy use* data back three years, or to the last *major renovation* if it occurred less than three years ago, or a minimum of one year's data), and *interviews* (for example, an inability to interview the key site manager, and so forth). (Refer to Practice E1527.)

3.2.8 *district energy, n*—is *secondary energy* that is generated off site and delivered to a facility in the form of steam, hot water, or chilled water.

3.2.9 *easily visible, adj*—describes *observations* of items, components and systems that are conspicuous, apparent, and obvious during the *walk-through* without: intrusion, relocation or removal of materials, exploratory probing, use of special protective clothing, or use of any equipment (such as hand tools, meters of any kind, ladders, and so forth). (Refer to Guide E2018.)

3.2.10 *energy use, n*—total electricity, natural gas, heating oil, district steam, district hot water, district cooling water, propane, and so forth, used by a facility for heating, cooling, ventilation, lighting, or powering other end uses in a building, with energy generated by *renewable energy sources* such as solar, wind or fuel cells separately identified (as these may be netted out when determining building energy use). The units of total building *energy use* are typically in thousands Btu per year (kBtu/yr). *Energy use* as described in this practice refers to *site energy use*.

3.2.11 *energy use equation, n*—relates the dependent variable, a building's total *site energy use*, including electricity and on-site fuel/district *energy use*, to independent variables whose variability is known to impact materially a building's *energy use*. Independent variables may, for example, include weather conditions (*HDD* and *CDD*), operating hours for the building, *occupancy* (or *vacancy*) rate, and number of *occupants*. Independent variables may also include any other variables judged to have a material influence on building *energy use* and deemed by the *BEPA consultant* to be available, appropriate, and relevant for the analysis. The *energy use equation* for a building may be calculated for a building's total energy use, for example, combined electricity and fuel, or separately for the building's electricity use and for the building's fuel use.

3.2.12 *energy use intensity (EUI), n*—total building *energy use* divided by the building's *gross floor area*. The units of building *energy use intensity* are typically kBtu/SF-yr. *EUI* is associated with a building of a specific property type with specific characteristics or other factors that may facilitate comparison with similar type buildings with similar characteristics (see Appendix X7 for a sample checklist of building characteristics that can impact *energy use* associated with select building types). *EUI* as described in this practice is determined on a *site energy use* basis.

3.2.13 *environmental site assessment (ESA), n*—process by which a person or entity observes a property, interviews knowledgeable *owner*s or *operator*s and state regulatory personnel, collects and reviews *reasonably ascertainable* government and historical property records for the purpose of identifying if a recognized environmental condition exists at the property. The *ESA* process is detailed in Practice E1527.

3.2.14 *good faith, n*—absence of any intention to seek an unfair advantage or to defraud another party; an honest and sincere intention to fulfill one's obligations in the conduct of a transaction. (Refer to Practice E1527.)

3.2.15 *gross floor area (GFA), n*—area on all floor levels within the perimeter of the outside walls of a building as measured from the inside surface of the exterior walls, with no deduction for hallways, stairs, closets, columns, or other interior features, excluding parking area. *Gross floor area* is distinguished from the leasable or rentable area, which is the occupied area on all floor levels for which a tenant is charged for *occupancy* under a lease. Leasable area may exclude common areas (such as lobbies and foyers, stairways and elevators, corridors and passages, mechanical rooms, rest rooms, and so forth). Only *gross floor area* is used in the energy metrics associated with this practice, for example, in the determination of *energy use intensity*.

3.2.16 *heating degree-days (HDD), n*—for each day with an average temperature lower than 65°F (18.3°C), *HDD* is the difference between the average temperature and 65°F (18.3°C). For example, on a day with a mean temperature of 40°F (4.4°C), 25 *HDD* would be recorded. *HDD* data by month and region is published by the Energy Information Administration. *HDD* historical data by month and region is published by NOAA's National Weather Service Climate Prediction Center, Camp Springs, MD for 200 major weather stations around the country, and by others, including NOAA's National Climatic Data Center in Ashville, NC. Information is also available at http://www.degreedays.net.

3.2.17 *heating value, n*—amount of heat produced by the complete combustion of a unit quantity of fuel. For the purposes of this practice, higher heating value (HHV) is used to convert the quantity of fuel to its energy content.

3.2.18 *interviews, n*—discussions with those knowledgeable about the property. (Refer to Guide E2018.)

3.2.19 *key site manager, n*—person identified by the *owner* or *operator* of a property as having knowledge of the physical and operational characteristics of the building or buildings on a property. (Refer to Practice E1527.)

3.2.20 *lower limit scenario, n*—with respect to building *energy use* or *EUI*, a reasonable lower limit for *energy use* or *EUI* at the building (see subsection 11.4.1.4). The lower limit scenario is determined using the 25th percentile for *HDD*, *CDD* and all other independent variables in the building *energy use equation*.

3.2.21 *major renovation, n*—building renovation that either involves expansion (or reduction) of the building's *gross floor area* by 10 % or more or impacts total building *energy use* by more than 10 %.

3.2.22 *normalize, v*—to reduce to a norm, such as normalizing building *energy use* by removing the influence of weather or building *gross floor area* or other conditions (referred to as normalizing factors). For example, to normalize a building's *energy use* (in kBTU/yr) using the building's *gross floor area* (in square feet), divide building energy use by the gross floor area. The resulting normalized quotient is in units of kBtu/SF-yr, also referred to as the *energy use intensity*.

3.2.23 *observation, n*—visual note of specific items, systems, conditions, or components that are observed during a *walk-through*. (Refer to Guide E2018.)

3.2.24 *occupancy, n*—occupied tenant space in a building. The *occupancy* rate generally refers to the occupied space in a building divided by the total space available to be occupied, generally represented as a percentage. Leased space is not always occupied space as the tenant may have left the space, but may still be paying the monthly lease cost under terms of the lease agreement.

3.2.25 *occupants, n*—those tenants, subtenants, or other persons or entities using the property or a portion of the property. (Refer to Practice E1527.)

3.2.26 *operator, n*—person responsible for, or the designated representative of the organization responsible for the overall operation of a property. (Refer to Practice E1527.)

3.2.27 *owner, n*—generally the fee *owner* of record of the property. (Refer to Practice E1527.)

3.2.28 *practically reviewable, adj*—information that is provided by the source in a manner and in a form that, upon examination, yields information relevant to the property without the need for extraordinary analysis of irrelevant data. (Refer to Practice E1527.)

3.2.29 *primary energy, n*—raw fuel, such as natural gas or fuel oil, that is burned on site at a building to create heat and/or electricity.

3.2.30 *pro forma building energy use, n*—building energy use (e.g., kBtu) determined from the *energy use equation* using the mean values for the independent variables, or the trailing twelve months of building *energy use* data if the independent variables identified in subsection 11.4.1 are within 15 % of the mean. *Pro forma building energy use* is considered representative of annual building *energy use* at the time of the *commercial real estate transaction* and is sometimes referred to as normalized building *energy use*. *Pro forma building energy use* is designed to reduce the influence [on building *energy use*] of biases such as unusual weather conditions (for example, an unusually warm winter or cool summer) or unusual building operational conditions (for example, an unusually high *vacancy* rate), etc.

3.2.31 *pro forma building energy use intensity, n*—building energy use intensity (e.g., kBtu/SF) determined from the energy use equation using the mean values for the independent variables, or the trailing twelve months of building *energy use intensity* data if the independent variables identified in subsection 11.4.1 are within 15 % of the mean. *Pro forma building energy use intensity* is considered representative of annual building *energy use intensity* at the time of the *commercial real estate transaction* and is sometimes referred to as the normalized building *energy use intensity*. *Pro forma building energy use intensity* is designed to reduce the influence [on building *energy use intensity*] of biases such as unusual weather conditions (for example, an unusually warm winter or cool summer) or unusual building operational conditions (for example, an unusually high *vacancy* rate), etc.

3.2.32 *pro forma building energy cost, n*—obtained by dividing actual trailing 12 month total cost ($) associated with each energy source used at the building by the associated *energy use* of the source (kBtu/yr), and then summing these values to get the total trailing 12 month building energy cost multiplier ($/kBtu/yr). The total trailing 12 month building energy cost multiplier is then multiplied by the average case scenario for annual *site energy use* (see subsection 11.4.1.4*(1)*). *Pro forma building energy cost* is considered representative of average annual building energy cost at the time of the *commercial real estate transaction*. *Pro forma building energy cost* is designed to reduce the influence [on building energy cost] of biases such as unusual weather conditions (for example, an unusually warm winter or cool summer) or unusual building operational conditions (for example, an unusually high *vacancy* rate), etc. *Pro forma building energy cost* may also be determined on square foot (*gross floor area*) basis.

3.2.33 *property condition assessment, n*—process by which a person or entity observes a property, interviews sources, and reviews available documentation for the purpose of developing an opinion about a property's current physical condition. A *property condition assessment* is detailed in Guide E2018.

3.2.34 *qualified consultant or individual, n*—person having the education, training, and experience necessary for the conduct of this practice (see also Appendix X4). The person may be an independent contractor or an employee of the *user*.

3.2.35 *real estate transaction, n*—transfer of title to or possession of real estate, rental of space in real estate under a lease for a set period of time in return for consideration, a transfer of a leasehold interesting real estate, or receipt of a security interest in real estate.

3.2.36 *reasonably ascertainable, adj*—information that is *readily available*, *practically reviewable*, and available at a nominal cost for retrieval, reproduction, or forwarding. (Refer to Practice E1527.)

3.2.37 *readily accessible, adj*—describes *easily visible* areas of a property that are promptly made available for *observation* by the *qualified consultant or individual* conducting the *walk-through* and do not require removal or relocation of materials or personal property, such as furniture, floor, wall, or ceiling coverings; and that are safely accessible. (Refer to Guide E2018.)

3.2.38 *readily available, adv*—describes information or records that are easily and promptly provided by a source to the individual making a request through an appropriate inquiry and without the need to research archive files. (Refer to Practice E1527.)

3.2.39 *renewable energy, n*—means a source of energy that occurs naturally or is regenerated naturally, including, without limitation:

(a) Biomass;

(b) Fuel cells;

(c) Geothermal energy;

(d) Solar energy;

(e) Waste heat (such as produced in a combined heat and power system);

(f) Waterpower (hydro); and

(g) Wind.

3.2.39.1 *Discussion*—The term does not include coal, natural gas, oil, propane or any other fossil fuel, or nuclear energy. *Renewable energy* systems may also be referred to as alternative energy systems.

3.2.40 *report, n*—written information prepared by a *qualified consultant or individual* and constituting an integral part of a *Building Energy Performance Assessment* as required by this practice.

3.2.41 *reporting period*—the period over which the amount of building energy use and costs are evaluated after the installation of energy conservation and/or *renewable energy* measures.

3.2.42 *secondary energy, n*—energy product (heat or electricity) created from a raw fuel, such as electricity purchased from the grid or energy (heat or cooling) received from a district system.

3.2.43 *site energy use, n*—amount of heat and electricity consumed by a building as reflected in its utility/energy bills or on-site generation or both, if any. *Site energy use* may also be referred to as building *energy use*. *Site energy* may be delivered to a building in one of two forms: *primary energy* or *secondary energy* or both. *Energy use* and the methodology developed in this practice are based upon *site energy use*.

3.2.43.1 *Discussion*—Site energy use is different from source energy use. Source energy use represents the total amount of raw fuel that is required to meet a building's energy needs and incorporates transmission, delivery, and production losses at/from the source (such as the local power plant). While source energy is not specifically used in the methodology associated with this practice, it is used by U.S. EPA to determine a building's greenhouse gas (carbon) emissions associated with combustion processes (refer to Appendix X9).

3.2.44 *site visit, n*—that part of the practice contained in Section 8 during which the *qualified consultant's* or *individual's walk-through* of the property takes place.

3.2.45 *total energy use, n*—sum of all energy consumed in the building, including purchased energy plus energy consumed on-site. Energy produced by the *renewable energy* systems is identified separately and may be netted out from building *total energy use*.

3.2.46 *upper limit scenario, n*—with respect to building *energy use* or *EUI*, a reasonable upper limit for *energy use* or *EUI* at the building (see subsection 11.4.1.4). The upper limit scenario is determined using the 75th percentile for *HDD*, *CDD*, and all other independent variables used in the building *energy use equation*.

3.2.47 *user, n*—party seeking to use this practice to complete a *building energy performance assessment*. A *user* may include, without limitation, a potential purchaser of the property, a potential tenant of the property, an *owner* of the property, a lender or a property manager.

3.2.48 *utility-energy bills/utility-energy data, n*—invoices from companies that provide energy to a building, including utility/energy companies, such as those that provide electricity, natural gas, district steam, district hot water, or district chilled water to a property, and companies that deliver oil, propane, kerosene, coal, coke, wood, or other fuels used at the building.

3.2.49 *vacancy, n*—empty or unoccupied tenant space in a building. The *vacancy* rate generally refers to the empty or unoccupied space in a building divided by the total space available to be occupied, generally represented as a percentage. If a tenant has left a space but still continues to pay rent on the vacated space in accordance with his or her lease obligation, the space is considered vacant for the purposes of this practice.

3.2.50 *walk-through, n*—conducted during the *site visit* consisting of *easily visible observation*s of readily accessible major building components and systems that can impact building *energy use*.

3.3 *Acronyms and Abbreviations:*

3.3.1 *ASHRAE*—American Society of Heating, Refrigerating and Air-Conditioning Engineers

3.3.2 *ASTM*—ASTM International

3.3.3 *BEPA—Building energy performance assessment*

3.3.4 *BTU*—British thermal units

3.3.5 *ECM*—Energy conservation measure

3.3.6 *EPA*—U.S. Environmental Protection Agency

3.3.7 *ESA—Environmental site assessment*

3.3.8 *EUI—Energy use intensity (typically in units of kBtu/SF)*

3.3.9 *GFA*—Gross floor area associated with a building

3.3.10 *GHG*—Greenhouse gas

3.3.11 *GWh*—Gigawatt (10^9 Watt) hour

3.3.12 *HHV*—Higher *heating value*

3.3.13 *HVAC*—Heating, ventilation, and air conditioning

3.3.14 *kBtu*—Kilo (10^3) British thermal units (Btu)

3.3.15 *kW*—kilowatt (10^3 Watt)

3.3.16 *kWh*—kilowatt (10^3 Watt) hour

3.3.17 *MBtu*—million (10^6) British thermal units (Btu)

3.3.18 *MWh*—megawatt (10^6 watt) hour

3.3.19 *NERC*—North America Electric Reliability Council

3.3.20 *NOAA*—National Oceanic and Atmospheric Administration

3.3.21 *NOI*—Net operating income

3.3.22 *PCA—Property condition assessment*

3.3.23 *ROI*—Return on investment

3.3.24 *SF*—Square foot [gross square feet of building]

4. Significance and Use

4.1 *Uses*—This practice is intended for use on a voluntary basis by parties who wish to conduct a *BEPA* on a building. The process defined in this practice involves the collection of building *energy use* information, some of which may be collected as part of Guide E2018 *PCA* or Practice E1527 *ESA*. The practice is intended primarily as an approach to conducting a standardized inquiry designed to identify representative *building energy performance* in connection with a commercial property involved in a *real estate transaction*. This practice is intended to reflect a commercially practical and reasonable inquiry.

4.2 *Clarifications on Use:*

4.2.1 *Use in Conjunction with Guide E2018 PCA or Practice E1527*—This practice, when added as a supplemental scope of work to a Guide E2018 *PCA* or a Practice E1527 *ESA*, is designed to assist the *user* and *consultant* in developing information about *energy use* in a building or buildings involved in a *real estate transaction*. The *BEPA* also has utility to a wide range of persons, including those who may not be involved in a *real estate transaction*.

4.2.2 *Independent Use*—This practice may also be used independently of any other building assessment to determine *building energy performance*.

4.2.3 *Site-Specific*—This practice is property-specific in that it relates to existing *building energy performance*. The practice is not intended to replace Guide E2018 *PCA* or Practice E1527 *ESA* conducted by a *qualified consultant* or *individual*, but rather to supplement it.

4.3 *Who May Conduct*—A *BEPA* shall be performed by a *qualified consultant* or *individual* (hereafter referred to as the "*Consultant*") with the education, training and experience necessary to perform the requirements of this practice (see Appendix X4). No practical approach can be designed to eliminate the role of professional judgment and the value and need for experience in the individual performing the inquiry. The professional experience of the *Consultant* is, consequently, important to the performance of this *BEPA*.

4.4 *Additional Services*—As set forth in Section 13, additional services may be contracted for between the *user* and the *Consultant*. Such additional services may include issues not included within the scope of this practice. For example, the *user* or *Consultant* may wish to benchmark the building against similar buildings in the portfolio or in the same geographical area or identify select green building attributes that may contribute to the energy efficiency performance and/or the building's valuation.

4.4.1 *Benchmarking Additional Service*—Any benchmarking system selected relies on critical data in generating its output, so the validity of the data collection process directly impacts the integrity and usefulness of the benchmarking system's results. Utilization of this practice and adoption of its data collection approach can serve to enhance the integrity of the benchmarking process for all transactional stakeholders in a standardized, fully transparent, uniform, and consistent manner. Notwithstanding, building *energy use* information should always be evaluated within the context in which it is collected and building *energy use* numbers should not be used without conveying this context. (Refer to Appendix X1 for additional information.)

4.5 *Principles*—The following principles are an integral part of this practice and are intended to be referred to in resolving any ambiguity or exercising such discretion as is accorded the *user* or *Consultant* in performing a *BEPA*.

4.5.1 *Uncertainty Not Eliminated in BEPA*—No *BEPA* practice can wholly eliminate uncertainty in determining the myriad of variables that can impact the *energy use* of a building on a property. The *BEPA* is intended to reduce, but not eliminate, uncertainty regarding the impact such variables can have on the *energy use* of a building.

4.5.2 *Not Exhaustive*—This practice is not meant to be an exhaustive assessment. There is a point at which the cost of information obtained or the time required to gather it outweighs the usefulness of the information and, in fact, may be a material detriment to the orderly completion of a *real estate transaction*. One of the purposes of this practice is to identify a balance between the competing goals of limiting the costs and time demands inherent in performing a *BEPA* and the reduction of uncertainty about unknown conditions resulting from collecting additional information.

4.5.3 *Level of Inquiry is Variable*—Not every building will warrant the same level of assessment. The appropriate level of assessment will be guided by the type of property subject to assessment and its complexity, the needs of the *user*, and the information already available or developed in the course of the inquiry.

4.6 *Rules of Engagement*—The contractual and legal obligations between a *Consultant* and a *user* (and other parties, if any) are outside the scope of this guide. No specific legal relationship between the *Consultant* and *user* was considered during the preparation of this practice.

5. Relationship to Practice E2018 *PCA* and Practice E1527 *ESA*

5.1 *Building Energy Performance Data Collected in Guide E2018*—Guide E2018 is directed principally at the physical status of a building and associated property, including the building's structure, electrical and mechanical systems, HVAC, roofing and plumbing systems, code compliance, parking lot, and sidewalk physical condition, with the objective of identifying deficiencies and the associated probable cost to remedy these deficiencies. While Guide E2018 does include identification of utilities provided to the property for heating, ventilation, and cooling equipment and other energy-related uses, it does not include the collection of building *energy use*

information. This practice is intended to supplement Guide E2018 when a *user* requests that *building energy performance* information be included in the *PCA*.

5.2 *Building Energy Performance Data Collected in Practice E1527*—Practice E1527 is directed principally at the environmental condition of the property, including whether known or suspect environmental contamination is associated with the property. Building energy use can impact the environment by directly or indirectly contributing to carbon emissions that may contribute to climate change. While Practice E1527 includes a building *walk-through*, interviews with key site personnel and collection of select building characteristics, it does not include the collection of building *energy use* information. This practice is intended to supplement Practice E1527 when a *user* requests that *building energy performance* information be included in the *ESA*.

5.3 *BEPA*—This practice is intended to be used independently or as a supplement to Guide E2018 *PCA* or Practice E1527 *ESA*.

5.3.1 The *BEPA* may be conducted concurrently with Guide E2018 *PCA* or Practice E1527 *ESA*.

5.3.2 The *BEPA* may be conducted independently of Guide E2018 *PCA* or Practice E1527 *ESA*. When conducting a *BEPA* independent of Guide E2018 *PCA* or Practice E1527 *ESA*, the data requirements specified in this practice shall be collected.

6. User Responsibilities

6.1 *Scope*—The purpose of this section is to describe tasks to be performed by the *user* that will assist the *Consultant* conducting the *BEPA* on a building connected to a *real estate transaction*. These tasks do not require the technical expertise of a *Consultant* and are generally not performed by *Consultants* performing a *PCA* or *ESA*, unless directed to do so by the *user*. In a *real estate transaction*, it is common for the *user* to be the prospective property purchaser (the buyer), with the *Consultant* working for this *user*. The *user* may also be an existing or prospective tenant at the property. Notwithstanding, the relevant information about the building is best obtained from the property *owner* (the seller), or *operator*, and/or *key site manager*. As such, it is not unusual to find the *user* requesting information directly from the seller, with the understanding that such person is under no legal obligation to provide the information. It is also not unusual to find the *user* requesting the *Consultant* to obtain the information needed directly from the seller (that is, as part of the *PCA* or *ESA* process). If the property *owner* (e.g., seller) is unwilling to provide building *energy use* and cost information, a *BEPA* cannot be performed. Appendix X5 provides a sample of information that may be collected from the property *owner*, *operator* or *key site manager* and which can assist the *user* and/or the *Consultant* gathering information on the building that may be material to the *BEPA* in connection with the *real estate transaction*.

6.2 *Specialized Knowledge or Experience of the User*—If the *user* has any specialized knowledge or experience that is material to the *BEPA* in connection with the building, it is the *user's* responsibility to communicate any information based on such specialized knowledge or experience to the *Consultant* before the *Consultant* conducts the *BEPA*.

6.3 *Nonresponsiveness*—If the *user* is unable to obtain the information requested directly from the property *owner* (or seller in a *real estate transaction*) or a designated representative, the *user* shall request authorization from the property *owner* for the *Consultant* to collect the information, if available, through an interview process with the property *manager*, *operator*, and/or the *key site manager*, and/or through a request to the responsible utility or energy provider or both. If the property *owner* (e.g., seller) is unwilling to provide building *energy use* and cost information, a *BEPA* cannot be performed.

6.4 *Other*—Either the *user* shall make known to the *Consultant* the reason why the *user* wants to have the *BEPA* performed (such as, for example, to meet a regulatory requirement or a financing requirement or a due diligence requirement) or, if the *user* does not identify the purpose of the *BEPA*, the *Consultant* shall assume the purpose is to evaluate *building energy performance* for the *user*. The *user* and the *Consultant* may also need to modify the scope of services performed under this practice for special circumstances, including, but not limited to, unique local or site-specific conditions.

6.5 *Non-existent Legal Obligation—Nothing in this practice is intended to create or imply the existence of a legal obligation for reporting of building energy performance or other building-related information. Any consideration of whether such an obligation exists under any federal, state, local or common law is beyond the scope of this practice.*

7. Building Energy Performance Assessment (BEPA) Process

7.1 *Objective*—The purpose of the *BEPA* described in this practice is to identify, to the extent feasible pursuant to the processes prescribed herein, *building energy performance* in connection with a *commercial real estate transaction*. Such *building energy performance* shall include: *(1)* historical *building energy performance* over the previous three years, with a minimum of one year, or back to the last building *major renovation* (if completed less than three years ago); *(2)* the range of building *energy use* and cost under average, upper limit and lower limit scenarios as defined in this practice (see subsection 11.4.1.4); *(3)* the *pro forma building energy use* and *pro forma building energy cost* (see subsections 11.5 and 11.6); and *(4) appropriate reporting* of building *energy use* and cost information to the *user* or other *user*-designated parties. The *BEPA* process described in this practice is intended to be used independently, or to supplement but not replace existing Guide E2018 *PCA* or Practice E1527 *ESA*.

7.2 *Report*—A separate *report* shall be prepared, unless the *BEPA* is being performed as part of an Guide E2018 *PCA* or Practice E1527 *ESA* conducted on a property connected to a *commercial real estate transaction*, in which case the *BEPA* findings and conclusions can be provided in the *PCA* or *ESA report*.

7.2.1 *Components*—A *BEPA* shall have five components described as follows:

7.2.1.1 *Site visit*—To observe the building during the *walk-through*, conduct *interviews* (see 7.2.1.2), and collect records (see 7.2.1.3) not previously provided to the *Consultant*; see Section 8.

7.2.1.2 *Interviews*—With the present *owner*, *operator*, and/or *key site manager* at the building; see Section 9.

7.2.1.3 *Records collection*—Collect and compile the records necessary to conduct the *BEPA*; see Section 10.

7.2.1.4 *Records review and analysis*—Review and analysis of records necessary to conduct the *BEPA*; see Section 11.

7.2.1.5 *Report*—On the findings related to building *energy use* and energy cost; see Section 12.

7.3 *Coordination of Parts:*

7.3.1 *Parts Used in Concert*—Data collected are intended to be used in concert with each other. If information from one source (for example, the records received) indicates the need for more information, other sources (for example, the *interviews*) may be available to provide this information.

7.3.2 *User's Obligations*—The *Consultant* shall note in the *report* whether or not the *user* has provided the *Consultant* with information pursuant to Section 6 of this practice.

7.4 *Consultant Conducting a BEPA:*

7.4.1 *Consultant's Duties*—The *BEPA* shall be performed by a *qualified Consultant* or *individual* (the "*Consultant*") or performed by others under the supervision of the *Consultant*. This can be the same individual(s) responsible for conducting the Guide E2018 *PCA* or Practice E1527 *ESA*. The assessment shall be performed by a person possessing sufficient knowledge, training, and experience necessary to conduct the site *walk-through*, *interviews*, data collection, and analysis defined in this practice and having the ability to identify issues relevant to *building energy performance* in connection with a building involved in a *real estate transaction*. At a minimum, the *Consultant* shall be involved in planning the assessment and the review and interpretation of the information upon which the *BEPA report* is based. Appendix X4 provides suggested qualifications for the *Consultant* responsible for conducting the *BEPA*.

7.4.2 *Information Obtained From Others*—Information for the records review needed for completion of a *BEPA* may be provided by a number of parties including the *user* or a designated representative; the building *owner*, *operator*, or *key site manager*; the local utility or energy provider; government agencies; or third-party vendors.

7.5 *Applicable Property Types for a BEPA*—A *BEPA* as described in this practice is appropriate for property where utility/energy costs are centralized and paid by the property *owner*, *manager*, or *operator* and may include, but are not limited to, office, retail, hotel/lodging, warehouse, multifamily and industrial properties. If *energy use* is not centralized such as in individual, separately metered units at multifamily-type properties or in separately metered tenant spaces at commercial office or retail buildings where energy costs are individually paid for by tenants, a *BEPA* as described in this practice is applicable only if unit or tenant space utility data is made available to the person conducting the *BEPA*. If only a sampling of unit or tenant space utility data is made available to the person conducting the *BEPA*, such sampling can be used only if it is: *(1)* judged to be representative of unit or tenant space at the building and *(2)* sufficient to estimate *energy use* for all tenants at the building.

7.6 *Reliance*—A *Consultant* is not required to verify independently the information provided by others and may rely on the information provided unless he or she has *actual knowledge* that certain information is incorrect, or unless it is obvious that certain information is incorrect based on the *Consultant's* experience or other information obtained in the *BEPA*.

8. Site Visit

8.1 *Objective*—The objective of the *site visit* is to: *(1)* interview persons at the building who are knowledgeable about building *energy use* and cost (see Section 9); *(2)* observe major building systems that can impact *energy use*; *(3)* collect available utility and other records, if not previously provided, including operation and maintenance data, from either building personnel or the utility/energy service provider servicing the property that will assist in analysis of building *energy use* (see Section 10); and *(4)* verify the information received, to the extent possible.

8.2 *Interviewing Knowledgeable Personnel during the Site Visit*—See Section 9.

8.2.1 *Identification of Key Site Manager before the Site Visit*—The *user* shall identify for the *Consultant* the *key site manager* or a knowledgeable representative at the property before the *site visit*.

8.2.2 *Interviewing the Key Site Manager*—The *key site manager* or a knowledgeable representative shall be interviewed during the *site visit* and accompany, if possible, the *Consultant* on the building *walk-through*.

8.3 *Observation during the Building Walk-Through*—Major building and site components that can impact *energy use* shall be visually observed. A sample checklist of the information that may be collected during the *walk-through* and *interviews* is included in Appendix X8.

8.3.1 *Exterior*—The periphery of the building shall be visually observed.

8.3.2 *Interior*—The interior of the building, accessible common areas expected to be used by *occupants* or the public (such as lobbies, hallways, utility rooms, recreation areas, and so forth), maintenance and repair areas, including boiler rooms, and a representative sample of occupant spaces, shall be visually observed. It is not necessary to look under floors, above ceilings, inside equipment, or behind walls.

8.4 *Obtaining Information on Building Characteristics*—*Observations* and *interviews* shall be used to provide a comprehensive building description in the *report* (refer to subsection 10.2 and Appendix X5). ASHRAE Procedures for Commercial Building Energy Audits may be used as a template.

8.5 *Collecting Available Building Energy Use and Cost Records at the Site*—See Section 10.

8.5.1 Before the *site visit*, the *Consultant* shall contact the *user* or, if authorized by the *user*, the building *owner*, *operator*, or *key site manager*, or other third parties such as the local

utility or utility bill payment service provider, and request specific records (see subsections 10.2 and 10.3) either to be forwarded before the *site visit* or be available for review during the *site visit*.

8.5.2 During the *site visit*, *Consultant* shall collect the following information, or confirm that such information collected prior to the *site visit* is complete.

8.5.2.1 Building *energy use* records over the previous three years, or back to the last *major renovation* (if less than 3 years ago), with a minimum period of one year.

8.5.2.2 Building energy cost records over the previous three years, or back to the last *major renovation* (if less than 3 years ago), with a minimum period of one year.

8.5.2.3 Other pertinent building *energy use* records or reports such as may be available, including, but not limited to energy audit reports, operation and maintenance records, as-built drawings, energy labeling reports (refer to Appendix X2, for example, ASHRAE or ENERGY STAR labeling reports), or green building rating or certification reports (refer to Appendix X2, for example, LEED certification or Green Globes certification reports).

8.6 *Review of Helpful Documents*—Before the *site visit*, the *property owner*, *key site manager*, or the *user* shall be asked if they know whether any of the information listed in 10.2 and 10.3 exist and, if so, whether copies can and will be provided to the *Consultant* either before or at the time of the *site visit*. Even partial information provided may be useful. If the information is provided before or at the time of the *site visit*, the *Consultant* conducting the *site visit* shall review the available documents before or at the beginning of the *site visit*.

8.7 *Frequency*—It is not expected that more than one visit to the *property* shall be made in connection with a *BEPA*. This visit may be conducted in conjunction with the *walk-through* survey conducted for the Guide E2018 *PCA* or the *site visit* associated with the Practice E1527 *ESA*, with the duration on-site depending, among other things, on property size and complexity.

9. Interview with Owner, Operator or Key Site Manager

9.1 *Objective*—The objective of the *interview* is to *(1)* interview persons at the building who are knowledgeable about building *energy use* and cost; *(2)* collect available utility and other records, if not previously provided, including operation and maintenance data, that will assist in analysis of *building energy performance* (see Section 10); and *(3)* verify the information received, to the extent possible.

9.2 *Content*—The *interview* with the building *owner*, *operator*, or *key site manager* consists of questions designed to: *(1)* collect *BEPA* supporting information if not previously provided; *(2)* fill in *data gaps* that exist in the information received; *(3)* confirm building operating characteristics; and *(4)* verify major building *energy use* systems.

9.3 *Medium*—Questions to be asked pursuant to this section may be asked in person (during the *site visit*), by telephone, or in writing, at the discretion of the *Consultant*.

9.4 *Who Should be Interviewed:*

9.4.1 *Key Site Manager*—Before the *site visit*, the *user* should be asked to identify a person with knowledge of the building and its physical and operational characteristics. Often the *key site manager* will be the property manager, the chief physical plant supervisor, or head maintenance person. If a *key site manager* is identified, the *Consultant* conducting the *site visit* shall arrange a mutually convenient appointment for the *site visit* when the *key site manager* agrees to be there. It is within the discretion of the *Consultant* to decide which questions to ask before, during, or after the *site visit* or in some combination thereof. The questions asked shall be directed at obtaining the information in 10.2 and 10.3 (see the sample checklist in Appendix X8).

9.4.2 *Quality of the Answers*—The person(s) interviewed should be asked to be as specific as reasonably feasible in answering questions. The person(s) interviewed should be asked to answer in *good faith* and to the extent of their knowledge.

9.4.3 *Incomplete Answers*—While the *Consultant* conducting the interview(s) has an obligation to ask questions, in many instances the persons to whom the questions are addressed will only be able to answer specific questions to the best of their knowledge. If the person being interviewed does not provide answers or provides only partial answers to specific questions, this section of the *BEPA* shall not be deemed incomplete, provided that sufficient information has been collected to allow the *Consultant* to complete the *BEPA*.

10. Records Collection

10.1 *Objective*—The purpose of *records collection* is to obtain and compile utility and other such records that will help identify: *(1)* historical building *energy use* over the previous three years, with a minimum of one year, or back to the last *major renovation* (if completed less than three years ago); *(2)* the range of building *energy use* and cost under average, *upper limit* and *lower limit scenario*s as defined in this practice; *(3)* *pro forma building energy use* and *pro forma building energy cost*; and *(4)* *appropriate reporting* of building *energy use* and cost information to the *user* or other *user*-designated parties.

10.1.1 *Accuracy and Completeness*—Accuracy and completeness of record information varies among information sources, including governmental and utility sources. Record information may be inaccurate or incomplete. The *user* or *Consultant* is not obligated to identify mistakes or insufficiencies in the information provided. However, the *Consultant* reviewing records shall make a reasonable effort to compensate for mistakes or insufficiencies in the information reviewed that are *obvious* in light of the *Consultant's* experience or other information of which the *Consultant* has *actual knowledge* or both.

10.1.2 *Reasonably Ascertainable Data*—Availability of record information varies among information sources, including governmental and utility sources. The *user* or *Consultant* is not obligated to identify, obtain, or review every possible record that might exist with respect to a building. Instead, the *user* or *Consultant* is required to review only record information that is *reasonably ascertainable*. Record information that is *reasonably ascertainable* means: *(1)* information that is *readily*

available; *(2)* information that is *practically reviewable*; and *(3)* information that is obtainable from its source within reasonable time and cost constraints.

10.1.2.1 *Readily Available*—Information or records that are easily and promptly provided by a source to the individual making a request through an appropriate inquiry and without the need to research archive files.

10.1.2.2 *Practically Reviewable*—Information that is *practically reviewable* means that the information is provided by the source in a manner and in a form that, upon examination, yields information relevant to the building without the need for extraordinary analysis of irrelevant data.

10.1.2.3 *Reasonable Time and Cost*—Information that is obtainable within reasonable time and cost constraints means that the information will be provided by the source within 20 calendar days of receiving a written, telephone, or in-person request at no more than a nominal cost intended to cover the source's cost of retrieving and duplicating the information. Information that can only be reviewed by a visit to the source is *reasonably ascertainable* if the visit is permitted by the source within 20 days of request.

10.1.3 *Coordination*—If records are not *reasonably ascertainable*, the *Consultant* shall attempt to obtain the requested information from other sources as determined by the *user* and *Consultant*. If the information is not available to conduct the *BEPA* described in this practice, the *Consultant* shall notify the *user* and determine what further action, if any, is appropriate.

10.2 *Building Characteristics Data*—The *Consultant* shall collect from the *user* or building *owner*, *operator*, or *key site manager* or other knowledgeable party the following information:

10.2.1 Building name and address;

10.2.2 Building type and category (see sample checklist in Appendix X7);

10.2.3 Building description, including, at the minimum, building construction, whether or not *renewable/alternative energy* sources (such as solar or wind) are used at the building, the number of floors, number of electric meters and areas covered, percent of floor area that is air conditioned, percent of floor area that is heated, approximate number of *occupants* in the building, weekly operating hours and description of tenants;

10.2.4 Description of parking area including, at the minimum, gross square footage, number of parking spaces, whether the parking is indoor (enclosed) or outdoor (unenclosed with a roof) or open (no roof or structure), whether or not the parking area is attached to the building, whether or not the parking area is individually metered for electricity use (for example, for lighting or ventilation in the case of in-building parking, or both);

10.2.4.1 If electricity use associated with a parking area for a building is not separately metered and the building's *EUI* will be compared to other similar buildings (not a part of the *BEPA* scope of work in this practice), the *Consultant* should estimate the electricity use of the parking area and exclude it from the building's energy use.

10.2.5 Building *gross floor area* in square feet (as distinguished from the building rentable or leasable square feet);

10.2.6 Year of construction, and applicable energy code at the time of construction, if *readily available*;

10.2.7 Completion date of the last *major renovation*, and applicable energy code at the time of renovation if *readily available*;

10.2.8 Monthly occupancy (or *vacancy*) rate going back three years (or to the last *major renovation* (if less than 3 years ago), with one year minimum);

10.2.9 Monthly operating hours going back three years (or to the last *major renovation* (if less than 3 years ago), with one year minimum);

10.2.10 Previous energy audit reports, if *readily available*;

10.2.11 Building energy labeling, rating and certification reports or sustainability certification reports, if *readily available*.

10.3 *Building Historical Energy Use*—The *Consultant* shall collect from the *user*, building *owner*, *operator*, or *key site manager* or other knowledgeable party (such as the local utility or energy provider) the following information over a three-year time period, or to the last *major renovation* (if completed less than 3 years ago), with a minimum period of one year:

10.3.1 *Electricity Use:*

10.3.1.1 Utility name,

10.3.1.2 Electricity use (kWh),

10.3.1.3 Peak electricity demand (maximum kW demand for each month of a twelve-month period), and

10.3.1.4 On-site electricity generation (kWh) and method, for example, from on-site solar panels or combined heat and power system.

10.3.2 *On-site Fuel for Heating or Cooling:*

10.3.2.1 Fuel type(s), including renewable energy;

10.3.2.2 Utility or provider name(s);

10.3.2.3 Fuel usage; and

10.3.2.4 Heating provided by a solar thermal system or waste heat produced by a combined heat and power system.

10.3.3 *District Steam, Hot Water, or Chilled Water:*

10.3.3.1 Type,

10.3.3.2 District system provider, and

10.3.3.3 Usage.

10.3.4 *Cost Data:*

10.3.4.1 Purchased total annual electricity cost,

10.3.4.2 Purchased total electricity cost per kWh,

10.3.4.3 On-site total annual fuel usage cost,

10.3.4.4 On-site total annual cost per unit of fuel used,

10.3.4.5 Total annual cost of district steam, hot water or chilled water, and

10.3.4.6 Total annual cost per unit of district steam, hot water, or chilled water.

10.4 *Weather Data*—Weather data representative of the area where the building is located (for example, at the nearest weather station) shall be collected, including:

10.4.1 Monthly *HDD* back three years or to the last *major renovation* of the building (if completed less than 3 years ago), with a minimum period of twelve consecutive months.

10.4.2 Monthly *CDD* back three years or to the last *major renovation* of the building (if completed less than 3 years ago), with a minimum period of twelve consecutive months.

10.5 *Documentation of Sources Checked*—The *report* shall document each source that was used, for example, utility bills, installed meters, and so forth. Supporting documentation shall be included in the *report* or adequately referenced to facilitate reconstruction of the assessment by a *Consultant* other than the *Consultant* who conducted it.

11. Records Review and Analysis

11.1 *Objective*—The purpose of records review and analysis is to review and analyze records collected in Section 10 that will help identify: *(1)* historical building *energy use* over the previous three years, with a minimum of one year, or back to the last *major renovation* (if completed less than three years ago); *(2)* the range of building *energy use* and cost under average, *upper limit* and *lower limit scenario*s as defined in this practice; *(3) pro forma building energy use* and *pro forma building energy cost*; and *(4) appropriate reporting* of building *energy use* and cost information to the *user* or other *user*-designated parties.

11.2 *Consistent Reporting of Energy Use Data*—Building *energy use* data shall be analyzed on a monthly average basis normalized for the calendar month. If data is reported for a non-calendar month period (such as for two partial months), the data shall be converted to a calendar month basis. This may be accomplished by determining average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. If raw fuel such as fuel oil, propane or coal, is delivered to a facility, *energy use* in a given time period may be estimated by the *Consultant* based upon the actual use between successive deliveries. Estimated monthly use for raw fuel may then be determined by pro-rating actual use between successive deliveries by an appropriate metric such as the *HDD* if the fuel is used for space heating. If the fuel is used for non-space heating, for example, domestic hot water, the extent of such may be determined from fuel usage when space heating requirements do not exist, for example, summer months.

11.3 *Building Energy Use Metrics*—Building *energy use* metrics shall be determined on an annual basis. When the metric is normalized by the *gross floor area*, this assumes that the *gross floor area* did not vary over the time period associated with the analysis. If a parking lot is associated with the building on which the *BEPA* is conducted, the *energy use* associated with this parking lot (such as, for example, the *energy use* associated with lighting in the parking lot) should not be included in the building *energy use* and EUI analysis but should be indentifed separately.

11.3.1 Determine electricity consumption in kWh/yr, kBtu/yr, kWh/SF-yr, and kBtu/SF-yr, with a brief description of the major electrical use end uses (for example, air conditioning, lighting, data center, and so forth). The conversion factor for electricity to Btu is 3,412.14 Btu/kWh or 3.41214 kBtu/kWh.

11.3.2 Determine on-site fuel usage in kBtu/yr and kBtu/SF-yr, with a description of on-site fuel use. *Heating values* of fuels reported on utility bills are typically adjusted for delivered heat content, elevation, and temperature, so additional corrections are not needed. If fuel content values are not available from the local utility, they may be estimated using the higher *heating value*s in Table 1. If the building is located at greater than 2000 ft (610 m) above mean sea level, gas *heating value*s should be adjusted for elevation as follows:

$$E_a = (E_u)(F_a)$$
$$F_a = (P_{atm} + P_{meter})/14.7$$

where:

E_a = adjusted gas *heating value*,
E_u = unadjusted gas *heating value*,
F_a = multiplication factor for elevation,
P_{atm} = $(14.7)(1 - 6.8754 \times 10^{-6}A)^{5.2559}$ psig,
P_{meter} = meter pressure in psig (if not known, assume 0.22 psig), and
A = elevation above mean sea level, feet.

11.3.2.1 For example, buildings at 2,000- to 4,000-ft (610- to 1,219-m) elevation will have an adjusted gas *heating value* approximately 92 % of the value in Table 1, and buildings at 4,000- to 5,000-ft (1,219- to 1,524-m) elevation will have an adjusted gas *heating value* approximately 86 % of the value in Table 1.

11.3.3 Delivered energy from district systems (steam, hot water, and/or chilled water) in kBtu/yr and kBtu/SF-yr, with a description of delivered *district energy*.

11.3.4 Energy generated on-site by *renewable/alternative energy* systems (such as solar voltaic, wind, combined heat and power systems) in kWh/yr, kBtu/yr, kWh/SF-yr, and kBtu/SF-yr, with a description of the alternative energy system and its operation.

11.3.5 *Total Energy Use* (as determined in 11.3.1 through 11.3.4) in kBtu/yr and kBtu/SF-yr. If an alternative energy system is used to satisfy a portion of total energy demand, *total energy use* shall be identified with and without the contribution of said *renewable/alternative energy* system.

11.4 *Building Energy Use and Cost Range*—Historical building *energy use* and costs may not be indicative of current

TABLE 1 Higher Heating Values (HHV) of Common Fuels[A]

Fuel	HHV
Fuel Oil	
#1	135,000 Btu/U.S. gallon
#2	139,000 Btu/U.S. gallon
#4	146,000 Btu/U.S. gallon
#5 Light	148,000 Btu/U.S. gallon
#5 Heavy	150,000 Btu/U.S. gallon
#6	154,000 Btu/U.S. gallon
Natural Gas	1,030 Btu/Std. Cu. Ft. (14.7 psia, 60°F) (1 therm = 100,000 Btu)
Propane	91,600 Btu/U.S. gallon
Coal	
Anthracite	12,700 Btu/lb
Semianthracite	13,600 Btu/lb
Low-volatile Bituminous	14,350 Btu/lb
Medium-volatile Bituminous	14,000 Btu/lb
High-Volatile Bituminous	11,000 to 13,800 Btu/lb
Subbituminous	8,500 to 9,000 Btu/lb

[A] ANSI/ASHRAE Standard 105-2007

energy use and costs based upon the manner in which the building is operated at the time of the *real estate transaction* and the prevailing utility/energy rates at that time. Moreover, external factors such as unusual weather conditions may have also impacted historical *energy use*. Energy cost information is a relatively significant building expense line item and impacts a building's net operating income (NOI). The building's *total energy use* shall be estimated for reasonable lower limit, reasonable upper limit, and average case conditions using the building *energy use equation* calculation procedure (see subsection 11.4.1) or any other manner in which the *Consultant* conducting the *BEPA* decides may be appropriate (for example, by analysis and extrapolation of the historical data or the trailing twelve-months data).

11.4.1 *Building Energy Use Equation*—The building *energy use equation* relates the dependent variable, total building *energy use*, including use of electricity and on-site fuel/district energy, to independent variables whose variability is known to impact materially building *energy use*. Independent variables may, for example, include weather conditions (*HDD* and *CDD*), operating hours for the building, occupancy (or vacancy) rate, and number of *occupants*. Independent variables may also include any other variable(s) judged to have a significant influence on building *energy use* and deemed by the *BEPA Consultant* to be available, appropriate, and relevant for the analysis. The *energy use equation* for the building may be determined for electricity and fuel separately, or for the total (combined) energy use.

11.4.1.1 *Calculation Procedure*—The building *energy use equation* can be determined using a weighted ordinary least squares regression. This basic form of multiple linear regression allows for analysis of a dependent variable (that is, building *energy use* in kBtu/SF-month), as a function of various independent variables or characteristics that can vary monthly (for example, heating degree days, cooling degree days, building *occupancy*, building operating hours, and so forth). The linear regression will yield an equation of the form:

$$\textit{Monthly Building Energy Use}\ (\text{kBtu/SF}) = C_0 + C_1 * \text{Characteristic}_1 + C_2 * \text{Characteristic}_2 + \ldots C_n * \text{Characteristic}_n$$

where C_0 represents a constant with the other C values representing equation coefficients. Characteristic_1 may be the actual monthly average *HDD*, for example, and Characteristic_2 the actual monthly average *CDD*, Characteristic_3 the actual monthly average *vacancy* level (%), and so forth. Assuming that three 3 years of monthly data are available and collected, there will be 36 sets of data points for the regression analysis. The *consultant* also has the option of conducting a more advanced regression analysis (such as, for example, a polynomial regression) if the ordinary least squares regression is judged unable to provide an acceptable fit. Most statistics packages available today include the capability to conduct multiple linear regression. The end result of this process will be the identification of the building's total monthly *energy use equation*.

11.4.1.2 *Treatment of Independent Variables that do not vary over the Time Period Considered*—If an independent variable such as *occupancy* or building hours of operation does not vary over the time period considered, it is not necessary to include it in the regression analysis. For example, if building *vacancy* rate (or *occupancy* rate) does not vary over the time period associated with the analysis, then the building *energy use equation* should not include it as an independent variable. Building *energy use* metrics developed in accordance with this practice shall specify any non-varying independent variable and disclose such in the *findings* section of the *report*.

11.4.1.3 *Statistical Analysis of Independent Variables:*

(1) Historical weather data, including monthly *HDD* and *CDD* data that is most applicable to the location of the building, shall be obtained for a minimum 10-year period. *HDD* and *CDD* data shall be statistically analyzed by month to identify the monthly average (mean), the 25th percentile for the month and the 75th percentile for the month.

(2) Assuming *occupancy* (or *vacancy*) data varied over the time period in which it was collected, such historical *occupancy* (or *vacancy*) data shall be statistically analyzed to determine the average *occupancy* level over the time period, and the 75th and 25th percentile *occupancy* levels.

(3) Assuming building operating hours varied over the time period in which it was collected, such historical operating hours data shall be statistically analyzed to determine the average over the time period and the 25th and 75th percentile values.

(4) Any other independent variables deemed available (for the full time period over which the investigation is being conducted), appropriate, and relevant for the analysis by the *Consultant* shall be analyzed statistically in a similar fashion.

11.4.1.4 *Determine Building Energy Use and EUI Range*—Using the building *energy use equation* developed in 11.4.1.1 and the independent variables included in 11.4.1.3, building *energy use* and *EUI* shall be determined under the following scenarios:

(1) Average case scenario—Monthly kBtu and kBtu/SF are determined using the monthly average for the independent variables in the building *energy use equation* and then summed up to determine the average annual *building energy use* in kBtu/yr and *EUI* in kBtu/SF-yr.

(2) Upper-limit scenario—Monthly kBtu and kBtu/SF are determined using the monthly 75th percentile for the independent variables in the building *energy use equation* and then summed up to determine the upper limit annual *building energy use* in kBtu/yr and *EUI* in kBtu/SF-yr.

(3) Lower-limit scenario—Monthly kBtu and kBtu/SF is determined using the monthly 25th percentile for the *HDD*, *CDD* and all other independent variables (determined relevant and appropriate by the *consultant* conducting the *BEPA*) in the building *energy use equation* and then summed up to determine the lower limit annual *building energy use* in kBtu/yr and *EUI* in kBtu/SF-yr.

(4) Building *energy use* range shall be the average (see 11.4.1.4), with the deviation (plus or minus) determined by the *lower limit* (see 11.4.1.4) and *upper limit scenario*s (see 11.4.1.4).

11.4.1.5 *Determine Building Energy Cost Multiplier*—The building energy cost multiplier is obtained by dividing the actual trailing 12 month cost ($) associated with each energy source used at the building by the associated *energy use* of the

source (kBtu), and then summing these values to get the total trailing 12 month building energy cost (in units of $/kBtu). The total trailing 12 month building energy cost multiplier is then multiplied by the appropriate *energy use* (kBtu/yr) to obtain the energy cost ($/yr).

11.4.1.6 *Determine Building Energy Cost Range*—Multiply the building energy cost multiplier by the upper limit *energy use* (see subsection 11.4.1.4), the lower limit *energy use* (see subsection 11.4.1.4) and the average *energy use* (see subsection 11.4.1.4) to obtain an average case, upper limit, and lower limit *total energy* cost range.

11.5 *Pro-Forma Building Energy Use—Pro forma building energy use* shall be determined using either: *(1)* the trailing twelve months of *energy use* data if the independent variables are within 15 % of the averages; or *(2)* the average case scenario for annual *building energy use intensity* (see 11.4.1.4). *Pro forma building energy use* is considered representative of total annual building *energy use* at the time of the *commercial real estate transaction*.

11.6 *Pro-Forma Building Energy Cost—Pro forma building energy cost* shall be based on the average *energy use* as determined in subsection 11.4.1.4 *(1)* multiplied by the building energy cost multiplier (see subsection 11.4.1.5). *Pro forma building energy cost* is considered representative of average annual building energy cost at the time of the *commercial real estate transaction*.

11.7 An illustrative example of the calculation procedure is provided in Appendix X11.

11.8 *Government/Utility Company Grant/Incentive Programs*—At the option of the *user*, government- and utility-sponsored energy efficiency grant and incentive programs that would likely be available for any energy efficiency improvements that might be installed at the building can be identified. Such information may be helpful to a *user* considering installation of such measures in the future. In the United States, a search of the DSIRE database (http://www.dsireusa.org) or similar such local databases as may be available may satisfy such a request (see Appendix X3).

11.9 *Use of the Building Energy Use Equation for Building Energy Performance Measurement and Verification After Installation of Energy Conservation Measures*—The *energy use equation(s)* for the building represents the baseline energy use prior to installation of energy conservation measures (*ECMs*). If *ECMs* are installed in a building, the *energy use equation(s)* can assist in determining the energy savings over the baseline. The energy savings can be determined by measuring actual energy use in the *reporting period* after the *ECMs* have been installed and comparing this actual energy use to the energy use that would have existed had the *ECMs* not been installed. The calculations involve collecting actual energy use (fuel and electricity) in the specified *reporting period*, along with actual values for the independent variables used to develop the baseline energy use equation for the building initially. The actual values for the independent variables collected in the reporting period are then inserted into the *energy use equation(s)* developed in 11.4.1 to determine what the building energy use would have been had the *ECMs* not been installed. The energy savings is the difference between the actual energy use measured in the reporting period after the *ECMs* have been installed and the calculated energy use had the *ECMs* not been installed. Values for the independent variables in the reporting period must be the same for both, that is, when the actual energy use data was collected and for the calculation made to determine the energy use without *ECMs*.

11.10 *Incorporating Uncertainty in the Building Energy Use Equation(s)*—Uncertainty in the building *energy use equation(s)* (for electricity use, fuel use, or combined total energy use) can be evaluated by comparing each actual monthly energy use in the baseline period with the energy use calculated using the *energy use equation(s)* developed for the building with the actual independent variables for that month. The difference between the monthly actual energy use and the calculated energy use from the building *energy use equation(s)* represents the error associated with the building *energy use equation(s)*. The mean (μ) is equal to the sum of the errors divided by the number of points (n). The standard deviation (σ) is equal to the square root of the sum of the square of each error (X) minus the mean (μ) divided by the number of points (n):

$$\sigma = \text{SQUARE ROOT}[\Sigma\ (X\ -\ \mu)^2/n] \quad (1)$$

Once the standard deviation has been determined, the uncertainty band around each energy use can be determined at a given confidence level. The confidence level defines the range around monthly energy use projected using the *energy use equation(s)*. For example, the 95% confidence range would be determined using 1.96 times σ (or 1.96σ). The 90% confidence level range would be determined using 1.645 times σ (or 1.645σ). Once a confidence level is selected, the range (plus or minus) around each energy use calculated from the *energy use equation(s)* can be determined. The energy savings realized by an *ECM* project is determined by the difference between the actual energy use in the *reporting period* and the projected (from the baseline) energy use had the *ECMs* not been installed. However, with uncertainty incorporated into the analysis, the difference between the upper boundary (depending on the confidence level selected) projected energy use curve in the *reporting period* without the *ECMs* installed and the actual energy use in the *reporting period* represents the upper limit energy savings, while the lower boundary projected energy use curve in the *reporting period* without the *ECMs* installed and the actual energy use in the reporting period represents the lower limit energy savings. If an energy savings guarantee has been made, so long as the guaranteed energy savings is within the energy savings range determined by actual measured energy use data in the *reporting period* and use of the upper and lower curves, the energy savings guarantee is presumed to have been met.

12. Evaluation and Report Preparation

12.1 *Report Format*—The *report* for the *BEPA* shall generally follow the recommended *report* format attached as Appendix X6 unless otherwise required by the *user*.

12.2 *Documentation*—The findings, opinions and conclusions in the *BEPA report* shall be supported by documentation. If the *Consultant* has chosen to exclude certain documentation

from the *report*, the *Consultant* shall identify in the *report* the reasons for doing so (for example, a confidentiality agreement). Supporting documentation shall be included in the *report* or adequately referenced to facilitate reconstruction of the *BEPA* by a *Consultant* other than the *Consultant* who conducted it.

12.3 *Contents of Report*—The *report* shall include those matters required to be included in the *report* pursuant to various provisions of this practice. The *report* shall also identify the *Consultant* and the person(s) with qualifications who conducted the *site visit*, *interviews*, and analysis. In addition, the *report* shall state whether the *user* reported to the *Consultant* any information pursuant to the *user's* responsibilities described in Section 6 of this practice.

12.4 *Scope of Services*—The *report* shall describe all services performed in sufficient detail to permit another party to reconstruct the work performed.

12.5 *Findings*—The *report* shall have a findings section that provides:

12.5.1 *Historical Energy Use over the Previous Three Years, with a Minimum of One Year, or back to the Building's Last Major Renovation (if Completed less than Three Years Ago):*

12.5.1.1 Monthly actual *building energy use* (electricity use in kWh and demand in kW, fuel use, and so forth);

12.5.1.2 Monthly actual building energy cost information (electricity, fuel, and so forth);

12.5.1.3 Average monthly weather data (for example, *HDD* and *CDD*);

12.5.1.4 Average monthly *occupancy* or *vacancy* rates;

12.5.1.5 Average monthly building operating hours;

12.5.1.6 Other available and deemed available, appropriate and relevant monthly data as determined by the *Consultant*;

12.5.1.7 Annual electricity consumption (kWh and kWh/SF) for each twelve-month period analyzed and annual average over the complete period of time analyzed;

12.5.1.8 Annual electricity cost (cost and cost/SF) for each twelve-month period analyzed and annual average over the complete period of time analyzed;

12.5.1.9 Annual fuel *energy use* (kBtu and kBtu/SF) for each twelve-month period analyzed and annual average over the complete period of time analyzed;

12.5.1.10 Annual fuel energy cost (cost and cost/SF) for each twelve-month period analyzed and annual average over the complete period of time analyzed;

12.5.1.11 Annual *total energy use* (*total energy use* in kBtu and *EUI* in kBtu/SF) for each twelve-month period analyzed and annual average over the complete period of time analyzed; and

12.5.1.12 Trailing 12 months *total energy* cost ($/kBtu/yr).

12.5.2 *Range of Building Energy Use under Lower-Limit, Upper-Limit, and Average Scenarios:*

12.5.2.1 Statistical analysis results for monthly *HDD* and *CDD* data over minimum 10-year period: average, 25th percentile and 75th percentile for each month;

12.5.2.2 Statistical analysis results for monthly *occupancy /vacancy* rate data (assuming variability): average, 25th and 75th percentile for each month;

12.5.2.3 Statistical analysis results for monthly building operating hours data (assuming variability): average, 25th and 75th percentile for each month;

12.5.2.4 Statistical analysis results for other varying monthly building data deemed available, appropriate and relevant for the analysis by the *Consultant*: average, 25th and 75th percentile for each month;

12.5.2.5 Average annual *building energy use* (in kBtu/yr) and *EUI* (in kBtu/SF-yr) using the monthly average for the independent variables;

12.5.2.6 Upper-limit annual *building energy use* (in kBtu/yr) and *EUI* (in kBtu/SF-yr) using the monthly 75th percentile for the independent variables;

12.5.2.7 Lower-limit annual *building energy use* (in kBtu/yr) and *EUI* (in kBTU/SF-yr) using the monthly 25th percentile for the independent variables.

12.5.3 *Pro Forma Building Energy Use and Pro Forma Building Energy Cost:*

12.5.3.1 *Pro forma building energy use* (in kBtu/yr) and *EUI* (in kBtu/SF-yr) and

12.5.3.2 *Pro forma building energy cost* (in $/yr and $/SF).

12.5.4 *(At the user's option)* Identification of grants and incentives that may be available from the government or local utility, or both, for measures to reduce the building's *energy use*.

12.6 *Appropriate Reporting*—The information determined in subsection 12.5 shall be *appropriately reported* to the *user* or other *user*-designated parties such that the *user* or *user*-designated parties are made aware of the variability and any assumptions connected with the findings (see also subsection 12.7). *Appropriate reporting* shall mean reporting the findings including all assumptions and limitations to enable the *user* to better understand the data and what precisely is being reported.

12.7 *Assumptions and Data Gaps*—The *report* shall identify and comment on significant assumptions and *data gaps* that can materially affect the *Consultant's* conclusions.

12.8 *Conclusions*—The *report* shall include a conclusions section that summarizes the findings. The *report* shall include a statement outlining the *Consultant's* conformance to the requirements of this practice and reference the limitations associated with building *energy use* information collected. Among the limitations to be considered for inclusion are variability of *energy use* information over time, the utilization of estimates in the absence of actual historic *energy use* information, and other considerations unique to the scope of services performed by the *Consultant* in any particular transaction. An example of one such statement is provided in subsection 12.8.1.

12.8.1 "We have performed a *BEPA* in conformance with the scope and limitations of Practice E2797 of [insert address or legal description], the building. Building *energy use* information at any point in time can exhibit considerable variability, depending upon, for example, weather conditions, the *occupancy* level, building operating hours and tenant behavior. As such the *BEPA* analysis reflects efforts to provide reasonable estimations of *energy use* based upon *reasonably ascertainable* data. Building *energy use* information should always be

evaluated within the context in which it was collected and building *energy use* numbers should not be used without conveying this context."

12.8.2 Any exceptions to, or deletions from this practice shall be described in the *report*.

12.9 *Additional Services*—Any additional services contracted for between the *user* and the *Consultant*, including a broader scope of assessment, such as peer building benchmarking analysis and recommendations for the implementation of specific no-cost/low-cost (see Appendix X10) or other energy saving measures, along with associated investment analysis such as return on investment (ROI), net present value (NPV) and payback time calculations, are beyond the scope of this practice, and shall only be included in the *report* if so specified in the terms of engagement between the *user* and the *Consultant*.

12.10 *References*—The *report* shall include a references section to identify published referenced sources relied upon in preparing the *BEPA*. Each referenced source shall be adequately annotated to facilitate retrieval by another party.

12.11 *Signature*—The *Consultant(s)* responsible for the *BEPA* shall sign the *report*.

12.12 *Appendices*—The *report* shall include an appendix section containing supporting documentation, the qualifications of the *Consultant* and the qualifications of the personnel conducting the *site visit* and *interviews* if conducted by someone other than a *Consultant*.

13. Non-Scope Considerations

13.1 *General:*

13.1.1 *Additional Issues*—There may be additional issues or conditions at a building that parties may wish to assess in connection with a *commercial real estate transaction* that are outside the scope of this practice (referred to as the non-scope considerations). For example the *user* may wish to benchmark the building's *energy use* against other similar buildings in the area, identify select green building attributes that can impact building *energy use* or the building's value or both conduct an energy audit, provide recommendations for the implementation of specific no-cost/low-cost energy saving measures (see Appendix X10), or provide associated investment analysis including return on investment (ROI), net present value (NPV) and payback time analysis.

13.1.2 *Outside Standard Practices*—Whether or not a *user* elects to inquire into non-scope considerations in connection with this practice or any other site assessments, no assessment of such non-scope considerations is required by this practice.

13.1.3 *Other Protocols and Programs*—There may be additional protocols or programs for the assessment and benchmarking of building *energy use* in connection with a *commercial real estate transaction* (see Appendix X2). Listed in subsections 13.1.3.1 – 13.1.3.6 are several other protocols and programs that *users* may want to consider in connection with a *commercial real estate transaction* or assessment of building energy performance.

13.1.3.1 ANSI/ASHRAE Standard 105-2014, Standard Methods of Determining, Expressing and Comparing Building Energy Performance and Greenhouse Gas Emissions.

13.1.3.2 ASHRAE Performance Measurement Protocols for Commercial Buildings (2010).

13.1.3.3 ASHRAE Procedures for Commercial Building Energy Audits (2011):

(1) Preliminary Energy Use Analysis.

(2) ASHRAE Level I Energy Use Analysis—Walk-Through Analysis.

(3) ASHRAE Level II Energy Use Analysis—Energy Survey and Analysis.

(4) ASHRAE Level III Energy Use Analysis—Detailed Analysis of Capital Intensive Modifications.

13.1.3.4 EPA ENERGY STAR Building Labeling Assessment—Statement of Energy Performance.

13.1.3.5 Green Globes Continual Improvement Assessment for Existing Buildings.

13.1.3.6 U.S. Green Building Council's LEED for Existing Buildings: Operations & Maintenance.

13.2 *No implication is intended as to the relative importance of inquiry into such non-scope considerations, and this list of non-scope considerations is not intended to be all-inclusive.*

14. Keywords

14.1 building energy performance assessment (BEPA); commercial real estate; energy; energy use; environmental site assessment (ESA); property condition assessment (PCA); real estate transaction

APPENDIXES

(Nonmandatory Information)

X1. LEGAL BACKGROUND ON FEDERAL, STATE AND LOCAL BUILDING ENERGY PERFORMANCE DISCLOSURE LEGISLATION AND REGULATION

INTRODUCTION

This practice is not intended to create any new legal obligation but rather to facilitate compliance with applicable laws and regulations, if any, under a set of facts pertaining to a specific commercial real estate transaction.

X1.1 Four generally used approaches incorporated into existing statues and regulations where a *BEPA* could be a commercially useful practice include: *(1)* transactional *building energy performance* benchmarking and disclosure; *(2)* recurring building labeling; *(3)* mandatory auditing; and *(4)* green building and energy code compliance.

X1.2 As of July 1, 2015, two states (California and Washington), one county (Montgomery County, MD) and thirteen cities (Atlanta, Austin, Berkeley, Boston, Cambridge, Chicago, District of Columbia, Minneapolis, New York City, Philadelphia, Portland (OR), San Francisco and Seattle) have commercial building energy benchmarking and disclosure policies. The status of benchmarking legislation and the most up-to-date information is maintained by the Institute for Market Transformation (IMT). Access to this information may be found at:
http://www.imt.org/uploads/resources/files/Commercial_Benchmarking_Policy_Matrix_-_8.1.14.pdf
It is incumbent on professionals conducting a *BEPA* to ascertain the most recent *building energy performance* disclosure regulations that may be applicable, if any, in the *commercial real estate transaction*.

X1.3 Among the issues which *users* of this practice may need to consider to comply with a legal or regulatory *building energy performance* disclosure obligation are: *(1)* benchmarking and the data collection process used; and *(2)* confidentiality considerations amongst landlords, tenants and utility providers. The following discussion addresses some of the specific considerations which should be reviewed in these two areas.

X1.3.1 *Benchmarking and the Data Collection Process*—The regulations cited in X1.2 require both building *energy use* and building characteristic data collection as a means to disclosing required benchmarking information and other pertinent building-related data to prospective purchasers, tenants, lenders, as well as government agencies. Because any benchmarking system selected relies on these data in generating its output, the validity of the data collection process directly impacts the integrity and usefulness of the benchmarking system's results. Utilization of this practice and adoption of the *BEPA* data gathering approach should serve to enhance the integrity of the benchmarking process for all transactional stakeholders in a standardized, uniform and consistent manner.

X1.3.1.1 Each of the *building energy performance* disclosure regulations identified in X1.2 reference ENERGY STAR as an acceptable benchmarking system. Three of the six (Washington, New York City and Austin) provide for utilization of available alternative benchmarking systems where, based on building type and other characteristics, ENERGY STAR may not be applicable, available or optimal. Some of the alternative benchmarking systems which could be considered to assure compliance with a specific regulation, subject to the characteristics of a particular building and the requirements of the *commercial real estate transaction* participants, are identified in Appendix X2. Appendix X7 includes a list of building characteristics that potentially can impact building *energy use* and that may be considered in utilizing the most appropriate benchmarking system. In transactions where multiple benchmarking systems are being considered, an understanding of how the underlying data collection process functions, given its fundamental impact on benchmarking calculations, should be reviewed in order to determine which benchmarking system may be most applicable. There are a number of factors that will influence the choice of an optimal benchmarking system, including:

(1) Intent of Benchmarking System Design—The intended purpose of a benchmarking system envisioned at the time of its creation will impact the underlying technical means by which it operates. This practice and its data collection process has been developed specifically to support regulatory disclosure and property due diligence which can have an impact on a business transaction. As such, Practice E2797 is focused on consistency, transparency and reliability.

(2) Building Characteristics Information—The number and nature of the building characteristics used for benchmarking in any benchmarking system can significantly impact the results and the reliability of the system. Practice E2797 allows for the collection of all important building characteristics that may have a significant impact on *energy use*.

(3) Historical Energy Use Data Collection Period—The period of time over which *energy use* data is collected and analyzed in a benchmarking system can significantly impact the results due to anomalies over the short term. Many existing benchmarking programs, for example, specify that *energy use* data be collected over the prior twelve months. Practice E2797 collects *energy use* data over the prior three years or goes back to the last *major renovation* if it occurred less than 3 years ago, thereby better able to compensate for short term anomalies.

(4) Energy Use Data Normalizing Process—Normalizing *energy use* data to adjust for extraneous events can impact the results of a benchmarking system. The normalization process

details (including the actual normalization calculation results) in many existing benchmarking programs, for example, are not readily apparent (or available) to a *user* and are generally based on a limited number of independent variables, primarily focused on building square feet, weather and limited building characteristics. The normalization process in this practice is fully transparent and allows for inclusion of as many independent variables (that can materially impact building *energy use* and whose data is *readily available*) as deemed appropriate and applicable by the *consultant* conducting the *BEPA*.

(5) Energy Use Intensity (EUI)—EUI is a key factor in determining the benchmarking rating for a building. Unlike benchmarking programs that only determine a single *EUI* for a building, this practice determines both a single *EUI* for the building (the *pro forma EUI*) and also an *EUI* range under reasonable *upper* and *lower limit scenario*s. The challenges associated with benchmarking and specifically how the data collection process can impact benchmarking outcomes in a *commercial real estate transaction* is further discussed in a recent paper, The Formidable Challenges of Building Energy Performance Benchmarking, which may be accessed at: http://www.bepinfo.com/images/PDF/BEPNwhitepaper-AB-3-30-10.pdf

X1.3.2 *Confidentiality Considerations*—Disclosure of *energy use* information can potentially impact the value of real estate as well as trade secret and other proprietary rights associated with the *occupants* of a building and their activities therein. Accordingly, due care needs to be taken to assure that only those parties with rights to *energy use* information have access to it. Generally speaking, such information does not "run with the building" but rather with the "utility bill payer". Further, tenants often have directly metered *energy use* arrangements with local utilities thus requiring that landlords obtain consent from one or multiple tenants in order to obtain all of the required information to fulfill disclosure obligations to third parties including buyers, lenders, appraisers and others who are utilizing this practice to conduct a *BEPA* in support of a *commercial real estate transaction*.

X1.3.2.1 The determination of who is an authorized party needs to be carefully considered so as not to violate provisions of lease agreements as between landlords, tenants and subtenants as well as loan documents between borrowers and lenders.

X1.3.2.2 Utilities are often specifically referenced within the regulations as having obligations to provide historical *energy use* information to an authorized party and/or directly to at least one designated benchmarking system as a means of facilitating compliance with the regulations. Utilities typically maintain an official release authorization form which allows the building *owner* and/or other third party such as a tenant who is responsible for utility charges to have historical *energy use* released to third parties.

X1.3.2.3 Complications can arise where a building has recently transacted and the new owner does not have authorization to obtain *energy use* history for a period prior to its *owner*ship and/or based on continuing challenges to access of such data controlled by tenants. Such considerations should be considered in the normal course of a *commercial real estate transaction* closing so as to transfer all such authorization to subsequent owners. The New York City statute, for example, addresses this issue by requiring tenants to routinely report *energy use* history to their landlord. The statute also requires that owners maintain historic *energy use* information for a period of no less than three years, often the period of time used to develop an accurate picture of historic *energy use*. This preservation of information can assist in assuring that such information is available at the time of a *commercial real estate transaction* when a *BEPA* is being conducted in accordance with this practice.

X2. BUILDING ENERGY PERFORMANCE AND SUSTAINABILITY LABELING PROGRAMS

X2.1 A *building energy performance* labeling program provides the general public, building owners and tenants, prospective owners and tenants, and building operations and maintenance staff with information on potential and actual *energy use* in buildings. This information is useful for a variety of reasons.

X2.1.1 Building owners and operators can see how their building compares to peer buildings to establish a measure of their potential for *building energy performance* improvement.

X2.1.2 Building owners can use the information provided to differentiate their building from others to secure prospective buyers or tenants.

X2.1.3 Prospective buyers or tenants can gain insight into the value and potential long-term cost of building ownership.

X2.1.4 Operations and maintenance staff can use the results to improve decisions on maintenance activities and influence building owners and managers to prioritize and pursue certain system upgrades to improve a building's energy efficiency that demonstrate the greatest return on investment.

X2.2 Additional information on building labeling, rating and certification programs may be found on the web. Some of these programs are identified below.

X2.2.1 ASHRAE Building Energy Quotient (EQ) Program (http://www.buildingeq.com)

X2.2.2 U.S. EPA ENERGY STAR (http://www.energystar.gov)

X2.2.3 U.S. DOE Building Energy Asset Score (http://energy.gov/eere/buildings/building-energy-asset-score)

X2.2.4 Green Globes Green Building Assessment and Rating System (http://www.thegbi.org)

X2.2.5 U.S. Green Building Council LEED Program (http://www.usgbc.org)

X2.2.6 Building Research Establishment Environmental Assessment Method (BREEAM) (http://www.breeam.org)

X3. GOVERNMENT AND UTILITY ENERGY EFFICIENCY INCENTIVE/GRANT PROGRAM TRACKING USING DSIRE

X3.1 The addition of any kind of government or utility financial incentive to install technology that will improve energy efficiency in a building will increase the return on investment. DSIRE (www.dsireusa.org/) is a comprehensive source of information on federal, state, local, and utility incentives designed to promote renewable energy and energy efficiency. Information is updated as it becomes available, usually daily. DSIRE was established in 1995 and is an ongoing project of the North Carolina Solar Center and the Interstate Renewable Energy Council (IREC) funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE), primarily through the Office of Planning, Budget and Analysis (PBA). The site is administered by the National Renewable Energy Laboratory (NREL), which is operated for DOE by the Alliance for Sustainable Energy, LLC. The N.C. Solar Center serves as a clearinghouse for solar and other renewable energy programs, information, research, technical assistance, and training for the citizens of North Carolina and beyond. Through its programs and services, the N.C. Solar Center seeks to stabilize energy costs for consumers, stimulate local economies, reduce dependence on foreign fuels, and mitigate the environmental impacts associated with fossil fuels. Established in 1988, the N.C. Solar Center is operated by N.C. State University's College of Engineering at North Carolina State University.

X3.2 There are two searchable databases: a renewable energy database and an energy efficiency database. These databases can be searched either by state or at the federal level. Searches are organized into two categories: *(1)* financial incentives and *(2)* rules, regulations, and policies. Users can also search by technology type, implementing sector (for example, federal, state, utility) or eligible sector (for example, commercial, residential). Searching by any of these criteria provides a comprehensive list of applicable incentives and policies with links to each program summary.

X4. CONSULTANT PROFESSIONAL QUALIFICATIONS AND RELEVANT EXPERIENCE

X4.1 *Consultant*:

X4.1.1 *Consultant* (*qualified Consultant* or *individual*) is defined in this practice; the term refers to a person who possesses the education, training, and experience necessary to meet the requirements of this practice and exercise professional judgment to develop opinions and conclusions. It is recognized that the qualifications of the individual(s) performing the *BEPA* are crucial to its accuracy and credibility.

X4.1.2 The competency of the *Consultant* is highly dependent on many factors that may include professional education, training, experience, certification, or professional licensing/registration.

X4.1.3 This practice recognizes that appropriate qualification levels may vary for different building types and scopes of work required under the *BEPA*.

X4.1.4 The qualifications of the individual(s) performing the *BEPA* should be included in the appendix of the *BEPA* report.

X4.2 *Relevant Experience*:

X4.2.1 Relevant experience with respect to this practice means having knowledge of building systems and components that consume energy, statistical analysis, and having professional designation in engineering (for example, licensed professional engineer, Association of Energy Engineers' Certified Energy Manager or Certified Energy Auditor, and so forth) or architecture (for example, licensed architect) or other demonstrated experience with building energy systems.

X4.2.2 Experience necessary should be commensurate with the type building and scope of work.

X5. INFORMATION THAT CAN BE COLLECTED FROM BUILDING OWNER/OPERATOR OR KEY SITE MANAGER

X5.1 Certain information in subsections 10.2 and 10.3 of this practice, if available, may be provided to the *Consultant* selected to conduct the *BEPA* by the prospective purchaser of the property and the property *owner* or *operator*. This information is intended to assist the *Consultant* in conducting the *BEPA*. *It is to be understood, however, that the seller or the seller's representative is under no legal obligation to provide the information to the Consultant.*

X5.2 Assuming the *BEPA* is being conducted for a prospective purchaser of a property (or other interested party), the following general information is appropriate to request:

X5.2.1 The reason why the *BEPA* is being requested (for example, for business reasons or to comply with an applicable energy disclosure regulation);

X5.2.2 Current or planned use of the property;

X5.2.3 The type of property transaction, for example, sale, purchase, exchange, lease, etc.;

X5.2.4 The complete name and correct address of the property (a map or other documentation showing property location and boundaries is helpful);

X5.2.5 The scope of services desired for the *BEPA* (including whether it is part of an E2018 *PCA* or E1527 *ESA* and whether it is to include any non-scope considerations);

X5.2.6 Identification of all parties who will rely on the *BEPA report*, such as a lender;

X5.2.7 Identification of the key site contact and how the contact can be reached; and

X5.2.8 Any special terms and conditions (such as confidentiality) which must be agreed upon by the *Consultant*.

X5.3 It is also appropriate to collect the following specific information from the property *owner* or *operator*, or property *key site manager* or other knowledgeable party (ASHRAE Procedures for Commercial Building Energy Audits may be used as a guide):

X5.3.1 Building type and category (refer to Appendix X7 for a sample checklist);

X5.3.2 Building description, including, at the minimum, building construction, whether or not renewable energy (such as solar) is used at the building, number of floors, number of electric meters and areas covered, percent of floor area that is air conditioned, percent of floor area that is heated, approximate number of occupants in the building, weekly operating hours and description of tenants;

X5.3.3 Description of parking area including, at the minimum, gross square footage, number of parking spaces, whether the parking is indoor (enclosed) or outdoor (unenclosed with a roof) or open, whether or not the parking area is attached to the building, if the parking area is individually metered for electricity use (for example, for lighting or ventilation);

X5.3.4 *Gross floor area* in square feet;

X5.3.5 Year of construction;

X5.3.6 Completion date of last *major renovation*;

X5.3.7 Monthly *occupancy* going back three years (or to the last *major renovation* (if less than 3 years ago), with one year minimum);

X5.3.8 Monthly operating hours going back three years (or to the last *major renovation* (if less than 3 years ago), with one year minimum);

X5.3.9 Previous energy audit reports, if available;

X5.3.10 Building energy labeling, rating and certification reports or sustainability certification reports, if available.

X5.3.11 Equipment operation and maintenance records, if available.

X5.3.12 Building as-built drawings and specifications, if available.

X5.4 It is also appropriate for the *Consultant* to collect the following building *energy use* and cost data from the *user*, building *owner*, *operator*, or *key site manager* or other knowledgeable party (such as the local utility) over a three-year time period, or to the last *major renovation* (if less than 3 years ago), with a minimum period of one year:

X5.4.1 Electricity
X5.4.1.1 Utility name
X5.4.1.2 Electricity consumption (kWh)
X5.4.1.3 Peak electricity demand (maximum kW per month for each month of a twelve-month period)
X5.4.1.4 On-site electricity generation

X5.4.2 On-site fuel for heating or cooling
X5.4.2.1 Fuel type(s), including *renewable/alternative energy*
X5.4.2.2 Utility or provider name(s)
X5.4.2.3 Fuel usage
X5.4.2.4 Waste heat produced by combined heat and power systems

X5.4.3 District steam, hot water or chilled water
X5.4.3.1 Type
X5.4.3.2 District system provider
X5.4.3.3 Usage

X5.4.4 Cost Data
X5.4.4.1 Purchased total annual electricity cost,
X5.4.4.2 Purchased total electricity cost per kWh,
X5.4.4.3 On-site total annual fuel usage cost,
X5.4.4.4 On-site total annual cost per unit of fuel used,
X5.4.4.5 Total annual cost of district steam, hot water or chilled water,
X5.4.4.6 Total annual cost per unit of district steam, hot water, or chilled water.

X6. RECOMMENDED TABLE OF CONTENTS AND REPORT FORMAT (Assuming the BEPA is Independent of the Phase I ESA or PCA)

X6.1 *Summary*:

X6.2 *Introduction*:
X6.2.1 Purpose
X6.2.2 Scope-of-Work
X6.2.3 Assumptions
X6.2.4 Limitations and Exceptions
X6.2.5 Special Terms and Conditions
X6.2.6 Reliance

X6.3 *Site Description*:
X6.3.1 Location and Legal Description
X6.3.2 Site General Characteristics
X6.3.3 Current/Planned Use of the Property
X6.3.4 Building Description

X6.4 *User Provided Information*:
X6.4.1 Reason for Conducting the *BEPA*
X6.4.2 Building *Energy Use* and Cost Information
X6.4.3 Other

X6.5 *Records Collection and Review*:
X6.5.1 Building Characteristics Information
X6.5.2 Utility Bill Information—electric, natural gas, fuel oils, purchased steam/hot water/chilled water, other
X6.5.3 Local, State, and Federal Government Building Renewable Energy and Energy Efficiency Grant/Incentive Programs (if included in the scope of work)
X6.5.4 Utility Company Building Renewable Energy and Energy Efficiency Grant/Incentive Programs (if included in the scope of work)
X6.5.5 Weather Data
X6.5.6 Other

X6.6 *Findings and Analysis of the Energy Performance of the Building*:
X6.6.1 Historical [Actual] Building *Energy Use* and Cost
X6.6.2 Range of Building *Energy Use* and *EUI* under upper, average, and lower limit scenarios
X6.6.3 Range of Building Energy Cost under *upper*, average, and *lower limit scenarios*
X6.6.4 *Pro Forma Building Energy Use* and *EUI*
X6.6.5 *Pro Forma Building Energy Cost*

X6.7 *Conclusions with Statement Indicating Conformance with the Practice*:

X6.8 *References*:

X6.9 *Signature(s) of Consultant(s)*:

X6.10 *Appendixes*:
X6.11.1 Site Map/Plan
X6.11.2 Site Photographs
X6.11.3 Records Documentation (historical utility/energy bills for minimum of twelve months)
X6.11.4 Prior *Building Energy Performance* Reports
X6.11.5 Interview Documentation
X6.11.6 Special Contractual Conditions between *User* and *Consultant*
X6.11.7 Qualification(s) of Consultant(s)

X7. SUPPLEMENTAL FIXED BUILDING CHARACTERISTICS THAT MAY IMPACT BUILDING ENERGY CONSUMPTION BY GENERAL PROPERTY TYPE WITH CATEGORIES AND SUBCATEGORIES

Property Type	Categories	Subcategories
☐ Office Buildings	☐ Location	☐ Climate Zone _____ (from DOE Climate Zones 1–8)
	☐ Class	☐ A[A] ☐ B[B] ☐ C[C]
	☐ Surroundings	☐ Stand-alone ☐ Attached to another building on one side ☐ Attached to another building on two sides ☐ Attached to another building on three sides ☐ Attached underground parking garage ☐ Attached indoor above ground parking garage ☐ Attached outdoor parking garage ☐ Unattached indoor parking garage ☐ Unattached outdoor parking garage ☐ Outdoor open parking ☐ No parking
	☐ Height	☐ Less than three stories ☐ Three–ten stories ☐ Greater than ten stories
	☐ Building Footprint (SF = _____)	☐ Rectangular ☐ Square ☐ Circular ☐ L-Shaped ☐ U-Shaped ☐ I-Shaped ☐ V-Shaped ☐ Other _____
	☐ Square Footage (GFA)	☐ Less than 5000 SF ☐ 5000–10 000 SF ☐ 10 001–25 000 SF ☐ 25 001–50 000 SF ☐ 50 001–100 000 SF ☐ Greater than 100 000 SF
	☐ Composition	☐ 100 % office ☐ Mixed with less than 10 % of gross SF as retail ☐ Mixed with 10 to 20 % of gross SF as retail ☐ Mixed with greater than 20 % of gross SF as retail ☐ Mixed with less than 10 % of gross SF as residential ☐ Mixed with 10 to 20 % of gross SF as residential ☐ Mixed with greater than 20 % of gross SF as residential ☐ Mixed with less than 10 % of gross SF as lodging ☐ Mixed with 10 to 20 % of gross SF as lodging ☐ Mixed with greater than 20 % of gross SF as lodging ☐ Mixed with less than 10 % of gross SF as _____ ☐ Mixed with 10 to 20 % of gross SF as _____ ☐ Mixed with greater than 20 % of gross SF as _____
	☐ Data Center	☐ Yes ☐ No
	☐ Backup power supply	☐ None ☐ Standby diesel ☐ Standby gas
☐ Retail Establishment	☐ Location	☐ Climate Zone _____ (from DOE Climate Zones 1–8)
	☐ Type	☐ Mall ☐ Open ☐ Enclosed ☐ Strip center

Property Type	Categories	Subcategories
		☐ Small Retail Store ☐ Box Store (Single Tenant) ☐ Other _____
	☐ Surroundings	☐ Stand-alone ☐ Attached to another building on one side ☐ Attached to another building on two sides ☐ Attached to another building on three sides ☐ Attached underground parking garage ☐ Attached indoor above ground parking garage ☐ Attached outdoor parking garage ☐ Unattached indoor parking garage ☐ Unattached outdoor parking garage ☐ Outdoor open parking
	☐ Building Footprint (SF = _____)	☐ Rectangular ☐ Square ☐ L-Shaped ☐ U-Shaped ☐ Other _____
	☐ Square Footage (GFA)	☐ Less than 5000 SF ☐ 5000–10 000 SF ☐ 10 001–25 000 SF ☐ 25 001–50 000 SF ☐ 50 001–100 000 SF ☐ 100 001–250 000 SF ☐ 250 001–500 000 SF ☐ Greater than 500 000 SF
	☐ Tenant Types	☐ Food store with refrigerators/freezers ☐ Dry cleaning/laundry ☐ Gas station ☐ Department Store ☐ Warehouse Store ☐ Auto Dealership ☐ General retail ☐ Other _____
	☐ Backup power supply	☐ None ☐ Standby diesel ☐ Standby gas
☐ Lodging	☐ Location	☐ Climate Zone _____ (from DOE Climate Zones 1–8)
	☐ Type	☐ Lodging only–rooms ☐ Lodging only–suites
	☐ Amenities	☐ Conference facilities ☐ Restaurant facilities ☐ Swimming pool facilities ☐ Atrium/public lobbies ☐ Health club/spa facilities
	☐ Surroundings	☐ Stand-alone ☐ Attached to another building on one side ☐ Attached to another building on two sides ☐ Attached to another building on three sides ☐ Attached underground parking garage ☐ Attached indoor above ground parking garage ☐ Attached outdoor parking garage ☐ Unattached indoor parking garage ☐ Unattached outdoor parking garage ☐ Outdoor open parking
	☐ Building Footprint (SF = _____)	☐ Rectangular ☐ Square ☐ Circular ☐ L-Shaped ☐ U-Shaped ☐ I-Shaped ☐ V-Shaped

Property Type	Categories	Subcategories
		☐ Other _____
	☐ Height	☐ Less than three stories ☐ Three–ten stories
	☐ Square Footage (GFA)	☐ Less than 5000 SF ☐ 5000–10 000 SF ☐ 10 001–25 000 SF ☐ 25 001–50 000 SF ☐ 50 001–100 000 SF ☐ Greater than 100 000 SF
	☐ Composition	☐ 100 % lodging ☐ Mixed with less than 10 % of gross SF as retail ☐ Mixed with 10 to 20 % of gross SF as retail ☐ Mixed with greater than 20 % of gross SF as retail ☐ Mixed with less than 10 % of gross SF as residential ☐ Mixed with 10 to 20 % of gross SF as residential ☐ Mixed with greater than 20 % of gross SF as residential ☐ Mixed with less than 10 % of gross SF as office ☐ Mixed with 10 to 20 % of gross SF as office ☐ Mixed with greater than 20 % of gross SF as office ☐ Mixed with less than 10 % of gross SF as _____ ☐ Mixed with 10 to 20 % of gross SF as _____ ☐ Mixed with greater than 20 % of gross SF as _____
	☐ On-site laundry	☐ Yes ☐ No
	☐ Backup power supply	☐ None ☐ Standby diesel ☐ Standby gas
☐ Multifamily	☐ Location	☐ Climate Zone _____ (from DOE Climate Zones 1–8)
	☐ Type	☐ Town houses ☐ Apartment building ☐ Condominiums
	☐ Access	☐ Walk-up ☐ Elevator
	☐ Number of units	☐ Less than 10 ☐ 10–50 ☐ 51–100 ☐ 101–200 ☐ Greater than 200
	☐ No. of units with no. of Bedrooms	☐ Studio _____ ☐ 1 Bedroom _____ ☐ 2 Bedroom _____ ☐ 3 Bedroom _____ ☐ 4 Bedroom _____
	☐ Square Feet/Unit	☐ Studio _____ ☐ 1 Bedroom _____ ☐ 2 Bedroom _____ ☐ 3 Bedroom _____ ☐ 4 Bedroom _____
	☐ Building Age	☐ Construction date _____
	☐ Central Laundry	☐ Yes ☐ No
	☐ Parking	☐ Underground parking garage ☐ Attached indoor parking garage ☐ Attached outdoor parking garage ☐ Unattached indoor parking garage ☐ Unattached outdoor parking garage ☐ Outdoor open parking ☐ No parking

Property Type	Categories	Subcategories
☐ Industrial	☐ Location	☐ Climate Zone _____ (from DOE Climate Zones 1–8)
	☐ Type	☐ Warehouse (storage/distribution) ☐ Refrigerated ☐ Nonrefrigerated ☐ Manufacturing (type) _____ ☐ NAICS or SIC Code _____ ☐ Capacity _____ ☐ Average Quarterly Production Level _____ ☐ Single Level ☐ Ceiling Height (ft) _____ ☐ On-Site Process Equipment with intense energy use: _____ _____
	☐ Square Footage (GFA)	☐ Less than 25 000 SF ☐ 25 000–50 000 SF ☐ 50 001–100 000 SF ☐ Greater than 100 000 SF
	☐ Surroundings	☐ Stand-alone ☐ Attached to another building on one side ☐ Attached to another building on two sides ☐ Attached to another building on three sides ☐ Unattached outdoor parking garage ☐ Outdoor open parking ☐ No parking ☐ Other _____
	☐ Building Footprint (SF = _____)	☐ Rectangular ☐ Square ☐ Other _____

[A] Class A office buildings can be characterized as the highest quality buildings in their market, with excellent location and access, the ability to attract high-quality tenants, and that are managed professionally. Building materials are high quality and these buildings command the highest rents in their market.
[B] Class B office buildings have good (versus excellent) locations, management, and construction, and tenant standards are high, but they command rents that are generally slightly lower than for Class A buildings. Class B buildings are generally a little older than Class A buildings.
[C] Class C office buildings are typically lower quality buildings with the lowest rents in their market. They are often located in less desirable areas and in need of extensive renovation.

X8. GENERAL COMMERCIAL BUILDING SURVEY CHECKLIST

X8.1 This checklist is designed to facilitate information collection by the prospective property purchaser (*user*) or *Consultant* from the property *owner* or *operator* or *key site manager*, or other knowledgeable party to conduct the *BEPA*. The following information should be completed to the best of the responder's knowledge, attaching supporting documentation where available. All previous green building labeling, ratings, certifications, and energy audit documentation should also be attached.

		Notes
Part 1	**General Building Information** **Date of Survey:** _____	
1	**General Survey Information** Building Name Building Street Address Building City, State, Zip Code Number of Buildings on Site (and Specific Identification of the Building being Surveyed) General Property Use General Building Description Appendix X7 Checklist Nearest Airport with Historical Weather Data Access Limitations During Survey Site Acreage	
2	**Owner, Operator, Key Site Manager Information** Building Owner Contact Name Building Owner Contact Title Building Owner Contact Phone Number Building Owner Contact Email Address Building Operator Contact Name Building Operator Contact Title Building Operator Contact Phone Number	

	Building Operator Contact Email Address	
	Building Key Site Manager Contact Name	
	Building Key Site Manager Contact Title	
	Building Key Site Manager Contact Phone Number	
	Building Key Site Manager Contact Email Address	
3	**Historical Documentation**	
	Architectural/As Built Plans	Title & Date of Document(s)
	Historical Monthly Occupancy Records	Title & Date of Document(s)
	Historical Monthly Hours of Operation Records	Title & Date of Document(s)
	Historical Monthly Utility/Energy Use Records	Title & Date of Document(s)
	Historical Monthly Utility/Energy Cost Records	Title & Date of Document(s)
	Previous Energy Audit Records	Title & Date of Document(s)
	Energy Management Operating Plan	Title & Date of Document(s)
	Other	Title & Date of Document(s)
	Previous Green Building Labeling, Rating & Certification Records:	
	ASHRAE Building EQ	Title & Date of Document(s)
	CMP Green Value Score	Title & Date of Document(s)
	EPA ENERGY STAR Rating	Title & Date of Document(s)
	EPA ENERGY STAR Building Label	Title & Date of Document(s)
	Green Globes Rating	Title & Date of Document(s)
	USGBC LEED Certification – NC	Title & Date of Document(s)
	USGBC LEED Certification – CS	Title & Date of Document(s)
	USGBC LEED Certification – CI	Title & Date of Document(s)
	USGBC LEED Certification – EB	Title & Date of Document(s)
	USGBC LEED Certification – Retail	Title & Date of Document(s)
	USGBC LEED Certification – Other	Title & Date of Document(s)
	Other	
4	**General Building(s) Information**	
	Building Type (for example, Class A Office)	
	Year Built	
	Completion Date of Last Major Renovation	
	Building Structural Description (for example, subgrade levels)	
	Number of Floors	
	Gross Floor Area in Square Feet	
	Floor Area Cooled in Square Feet/%	
	Floor Area Heated in Square Feet/%	
	Heating Source(s)	
	Renewable Energy Use	
	Roof Description	
	Weekly Building Operating Hours (tenant use)	
	Description of Tenant Types	
	Parking Space Information:	
	Open Parking Area – GSF not under roof	
	Non-Enclosed Area – GSF under roof but not enclosed	
	Enclosed/Garage Area – GSF under roof	
	Garage Floors Above Ground	
	Garage Floors Below Ground	
	Weekly Hours of Parking Area Access	
	Energy Use (Lighting, etc.)	

Part 2	**Detailed Technical Information Survey**	Owner Disclosure	Observed on Site Visit	Notes
5	**Building Electrical Information**			
	Number of Electric Meters Serving Building			
	Single			
	Multiple			
	Tenant-level Sub-Meters?			
	On-Site Renewable Energy Sources?			
	Solar			
	Wind			
	Combined Heat & Power			
	Geothermal			
	Other			
6	**Building Interior Lighting Information (Note: includes Enclosed Garage Area)**			
	Type Lighting Fixtures:			
	T12 Fixtures			
	T8 Fixtures			
	T5 Fixtures			
	Other Fixture Types			
	Building Energy Management System (monitoring, occupant sensors, timer controls of interior lighting systems?)			

Part 2	Detailed Technical Information Survey	Owner Disclosure	Observed on Site Visit	Notes
7	**Building Exterior Lighting Information** **(Note: Includes Open and Non-Enclosed Parking)** Type Lighting Fixtures Separate electrical panel (Y/N) Weekly Hours of Operation Energy Management System (monitoring, sensors, timer controls of exterior lighting systems?)			
8	**Building Air Conditioning (AC) Information** Equipment ENERGY STAR Rated? Age of AC Equipment Number/Capacity AC Systems GSF of Floor Area Covered by AC (SF/%) AC on an Energy Management System (EMS) Electrical or Fuel Use Specifications Weekly Hours of Operation (if different from 4) Thermostat /Timer Description Supplemental Cooling Sources? Individual Window AC Units Individual Fans Other			
9	**Building Hot Water Production Information** Type of Hot Water Equipment (ENERGY STAR Rated?) Location of Hot Water Equipment Size/Capacity Electrical or Fuel Use Specifications			
10	**Building Boiler and Steam Distribution Information for Heating** Type of System Equipment Utilized Size/Capacity Electrical or Fuel Use Specifications Supplemental Heating Sources? (Space heaters, etc.)			
11	**Large Electrical Motor Information** Location and Use of Large Motors (e.g., elevators) Use of Energy Efficient Motors? Electrical or Fuel Use Specifications Weekly Hours of Operation (if different from 4)			

Part 2	Detailed Technical Information Survey	Owner Disclosure	Observed on Site Visit	Notes
12	**Building Occupant Personal Computers** Number of Occupants Estimated Number of Computers Hours of Operation (if different from 4)			
13	**Building Computer Data Center/Server Rooms** Type of Computer Data Center(s) Location of Computer Data Center(s) GSF of Computer Data Center(s) Percent of Total Building GSF the Data Center(s) Occupies Weekly Hours of Operation of the Computer Data Center(s) (note peak and off-peak times if known)			
14	**Building Specialty Equipment (for example, Commercial Refrigeration Units, Lab Equipment, and so forth)** Location and Type of Specialty Equipment Space GSF of Specialty Equipment Space Percent of Total Building GSF the Specialty Equipment Space(s) Occupies Weekly Hours of Operation of the Specialty Equipment Space(s) (note peak and off-peak times if known)			
15	**Building Industrial/Manufacturing Equipment** Location and Type of Industrial/Manufacturing Equipment Space GSF of Industrial/Manufacturing Equipment Space Percent of Total Building GSF the Industrial/Manufacturing Equipment Space(s) Occupies Weekly Hours of Operation of the Industrial/ Manufacturing Equipment Space(s) (note peak and off-peak times if known)			
16	**Building Environmental Stewardship Information**			
	Refrigerant Management Plan			Title & Date of Document(s)
	Greenhouse Gas Emissions Reporting Plan			Title & Date of Document(s)
	Use of Low VOC Materials Policy/Plan			Title & Date of Document(s)
	Sustainable Purchasing Policy/Plan			Title & Date of Document(s)
	Solid Waste Management Plan (Recycling)			Title & Date of Document(s)
17	**Building Water Efficiency Information**			
	Water Efficiency Plan			Title & Date of Document(s)

X9. ESTIMATING CARBON EMISSIONS ASSOCIATED WITH COMBUSTION PROCESSES RELATED TO ENERGY USE IN A COMMERCIAL BUILDING

INTRODUCTION

Note—Appendix X9 is nonmandatory. It has been provided at the request of the commercial real estate industry for informational purposes only. The U.S. EPA is the source of the majority of the information included herein.

The methodology described in this Appendix can be used to estimate carbon emissions from a building. Such carbon emissions represent the amount of carbon dioxide equivalent, CO_2e (representing emissions of the combustion-related greenhouse gases (GHGs): carbon dioxide, methane, and nitrous oxide) emitted annually to the atmosphere from the combustion of fossil fuels to produce heat and power for the building. Total carbon dioxide equivalent is determined for both direct and indirect emissions. Direct emissions result from the on-site combustion of fuels. Indirect emissions result from off-site combustion of fuels at power plants that, for example, deliver electricity to the building. Source energy use considers both direct and indirect emissions associated with a building. It represents the

total amount of raw fuel that is required to operate a building. For energy that may be delivered to a building, that is, electricity, district steam, district hot water, or district cooling water, source energy use considers transmission, delivery, and production losses associated with the source providing the energy.

If electricity or hot water is generated on site by renewable/alternative energy systems, for example, a solar photovoltaic system or wind energy generator technology or a combined heat and power system, such electricity or hot water is not included in determining the building's carbon emissions. If electricity generated on site exceeds the needs of the facility and is sent off site to the local grid, the building's carbon emissions are credited accordingly. A building's total GHG footprint also considers hydrofluorocarbon emissions from air-conditioning and refrigeration units and perfluorocarbon and sulfur hexafluoride emissions typically associated with certain types of industrial processes. Such emissions, however, typically are insignificant in buildings associated with commercial real estate transactions compared to combustion-related GHG emissions and are not included in the carbon emission methodology described below. The building's carbon emissions as determined below also do not include carbon emissions associated with business-related air travel and automobile commuting by building occupants.

X9.1 *Estimation of Building Carbon Emissions*—Building *carbon emissions* are determined using the building's average source *energy use*. The building's average source *energy use* includes the building's average *energy* use (see subsection 11.4.1.4), including both direct energy used (for example, fuel oil or natural gas for heating) and indirect energy used (for example, electricity used for ventilation, air conditioning, lighting, office equipment, and so forth or purchased district energy), and, for delivered energy (including electricity and *district energy*), the production, transmission and delivery losses.

X9.1.1 *Direct Carbon Emissions:*

X9.1.1.1 Direct energy used at the building is used to determine the carbon emissions from on-site fuel usage.

X9.1.1.2 On-site direct energy used in MBtu/yr (million Btu/yr) is multiplied by the kg CO_2e/MBtu in Table X9.1.

X9.1.2 *Indirect Carbon Emissions:*

X9.1.2.1 *Electricity:*

(1) Building average electricity use is used to determine the carbon emissions associated with electricity usage. Convert annual kWh to annual MBtu using the conversion factor of 0.003 414 4 MBtu/kWh.

(2) Contact the local utility to obtain the appropriate and most up-to-date carbon emission factor based on the current fuel mix. Alternately, select the greenhouse gas emission factor (kg CO_2e/MBtu) from Table X9.2 for the electricity grid (eGRID subregion) the property is located in (refer to Fig. X9.1). An eGRID subregion represents a portion of the U.S. power grid that is contained within a single North America Electric Reliability Council (NERC) region that have similar emissions and resource mix characteristics and may be partially isolated by transmission constraints. As an estimation to account for line losses, multiply the emission factor by 1.0641. The approximate kilograms of greenhouse gas emissions in CO_2e to satisfy the building's annual electricity demand will then be this emission factor multiplied by the building's average electricity use in annual MBtu. Table X9.2 uses data based upon fuel mixes that existed at utilities in 2010.

X9.1.2.2 *District Systems:*

TABLE X9.1 Direct Carbon Emission Factors for Stationary Combustion[A]

Fuel Type	kg CO_2/MBtu	kg CH_4/MBtu	kg N_2O/MBtu	kg CO_2e/MBtu
Natural Gas	53.0567	0.0052709	0.0001054	53.200036
Fuel Oil (No. 2)	73.15	0.0105419	0.0006325	73.567457
Wood	93.8667	0.3162555	0.0042167	101.815222
Propane	63.0667	0.0105419	0.0006325	63.484124
Liquid Propane	63.162	0.0105419	0.0006325	63.579457
Kerosene	72.3067	0.0105419	0.0006325	72.724124
Fuel Oil (No. 1)	73.15	0.0105419	0.0006325	73.567457
Fuel Oil (No. 5 & No. 6)	78.7967	0.0105419	0.0006325	79.214124
Coal (anthracite)	103.62	0.0105419	0.0015813	104.331575
Coal (bituminous)	93.4633	0.0105419	0.0015813	94.174908
Coke	113.6667	0.0105419	0.0015813	114.378242
Fuel Oil (No. 4)	73.15	0.0105419	0.0006325	73.567457
Diesel	73.15	0.0105419	0.0006325	73.567457

[A]U.S. EPA, Climate Leaders Program, Direct Emissions from Stationary Combustion Sources, Appendix B, May 2008. www.epa.gov/climateleaders/documents/resources/stationarycombustionguidance.pdf

TABLE X9.2 Indirect Carbon Emission Factors for Purchased Electricity[A]

Electricity Grid by eGRID Subregion (see map in Fig. X9.1)	kg CO_2/MBtu	kg CH_4/MBtu	kg N_2O/MBtu	kg CO_2e/MBtu
NEWE (New England)	147.45	8.20	1.61	148.12
NYCW (New York City)	150.76	3.14	0.33	150.92
NYLI (Long Island, NY)	192.63	4.53	0.52	192.88
NYUP (Upstate NY)	167.03	4.91	1.82	167.69
RFCE (Mid Atlantic)	208.18	4.79	2.67	209.11
SRVC (Virginia/Carolina)	216.44	4.85	3.07	217.50
SRTV (Tennessee Valley)	249.63	3.33	3.85	250.89
SRMV (Lower Mississippi)	162.85	3.69	0.88	163.20
SRSO (SE US, Gulf Coast)	209.75	3.53	2.86	210.70
FRCC (Most of Florida)	170.18	5.16	1.44	170.73
RFCM (Most of Michigan)	232.40	4.30	3.46	233.57
RFCW (Ohio Valley)	264.16	3.26	4.14	265.51
MROE (Eastern WI)	233.89	4.20	3.73	235.13
SRMW (Middle Mississippi)	261.77	3.19	3.95	263.07
MROW (Upper Midwest)	273.71	7.97	4.73	275.34
SPNO (KS-Western MO)	260.02	3.35	3.58	261.20
SPSO (TX Panhandle-OK)	191.34	3.72	1.61	191.92
ERCT (Most of TX)	157.43	2.68	1.02	157.80
RMPA (CO-Eastern WY)	240.87	3.27	3.05	241.88
AZNM (Southwest US)	161.26	2.92	1.31	161.72
NWPP (Northwest US)	178.56	5.51	2.38	179.41
CAMX (Southwest Coast)	124.27	4.78	0.61	124.56
HIMS (HI excluding Oahu)	225.24	13.86	2.55	226.32
HIOA (Oahu Island)	211.58	15.92	2.68	212.75
AKMS (Most of Alaska)	190.21	7.99	1.57	190.86
AKGD (So/Central Alaska)	184.83	4.54	0.92	185.21
National Average	202.52	4.17	2.44	203.37

[A] U.S. EPA's Emissions & Generation Resource Integrated Database (eGRID), eGRID 9th Edition, Version 1.0 (updated February 2014 with the complete release of year 2010 data). Emission factors are non-baseload output emission rates. Data are organized to reflect the owner, operator, and electric grid configuration as of October 1, 2007. http://www.epa.gov/cleanenergy/egrid

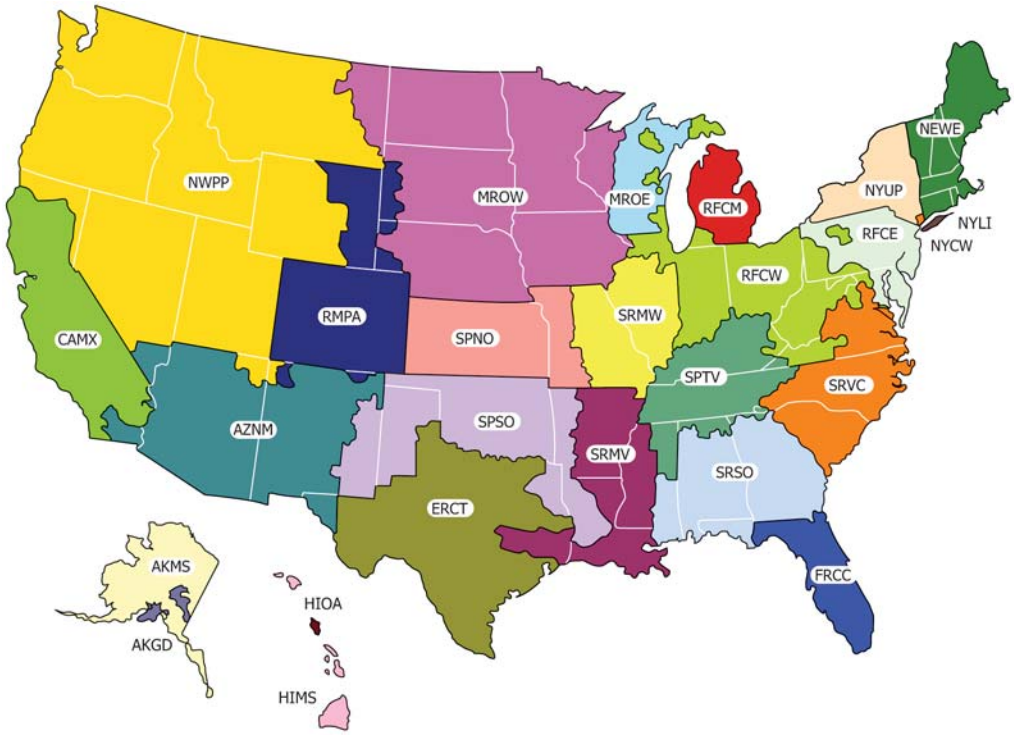

FIG. X9.1 Electricity Grid by eGrid Subregions

(1) Average *energy use* is used to determine the carbon emissions from district system steam or hot water or chilled water in MBtu.

(2) Select the carbon emission factor (kg CO_2e/MBtu) from Table X9.3. These factors already take into account transmission losses. While the production of chilled water

TABLE X9.3 Indirect Carbon Emission Factors (District Energy)[A]

Fuel Type	kg CO_2e/MBtu
District Steam	78.95
District Hot Water	78.95
District Chilled Water – Electric Driven Chiller	0.238095* (Table X9.1 Emission Factor)
District Chilled Water – Absorption Chiller using Natural Gas	66.5
District Chilled Water – Engine-Driven Chiller using Natural Gas	44.33

[A] Instructions for Form EIA-1605, Voluntary Reporting of Greenhouse Gases, Energy Information Administration, Department of Energy, October 15, 2007. Appendix N: Emissions Benchmarks for Purchased Steam and Chilled/Hot Water. http://www.eia.doe.gov/oiaf/1605/pdf/EIA1605_Instructions_10-23-07.pdf

today typically uses electric-driven chiller technology, the local energy supplier may be contacted to confirm the chilled water production method.

(3) The approximate kilograms of carbon emissions in CO_2e to satisfy the building's annual purchased district steam or hot water or chilled water demand will then be this emission factor multiplied by the average *energy use* in annual MBtu.

X9.1.3 *Renewable/Alternative Energy Sources*—If there are no carbon emissions resulting from the consumption of electricity produced from *renewable/alternative energy* sources such as on-site photovoltaic or wind generation resources, site electricity consumption provided by such sources is multiplied by an emission factor of zero (0) kg CO_2e/MBtu.

X9.2 *Building Carbon Emissions*—The sum of the kg CO_2e emitted from each source is the total annual amount of combustion-related carbon emissions associated with *energy use* at the building. This also represents a reasonable approximation for the amount of carbon emissions that would have to be offset for the building to be considered carbon neutral. (Before acquiring offsets, all reasonable measures to reduce *energy use* (see Appendix X10) should be implemented in order to minimize the quantity of offsets that would need to be acquired to be carbon neutral. If a prospective purchaser is interested in acquiring a building that is carbon neutral, carbon offsets may be purchased from any number of sources, including both for-profit and nonprofit providers. When purchasing carbon offsets, providers should be carefully evaluated to verify their offsets are legitimate and consistent with international standards.)

X10. COMMON NO-COST/LOW-COST ENERGY SAVING MEASURES FOR COMMERCIAL BUILDINGS

X10.1 Energy is a significant and growing cost for most businesses. A review of how energy is used in buildings and then targeting improvements in equipment and procedures can lead to significant cost savings. Many criteria can be used in the decision-making process. The most frequently considered are total costs, return on investment, ease of implementation, and the installation timeframe. Summarized in X10.2 and X10.3 are some of the more common no-cost or low-cost energy-saving measures for commercial buildings that should be given the highest priority.

X10.2 *No-Cost Measures*:

X10.2.1 Measure and track building energy performance.

X10.2.2 Educate tenants and employees about how their behaviors affect *energy use* (for example, turning off computers, and unplugging chargers and other accessories, coffee-makers, and so forth when not in use).

X10.2.3 Turn off lights when not in use or when natural daylight can be used (instruct night and weekend security staff to turn off lights as well).

X10.2.4 Set back the thermostat in the evenings and at other times when the building is unoccupied.

X10.2.5 Lock thermostats in publicly accessible areas to prevent unauthorized adjustments.

X10.2.6 Make sure thermostats are properly placed (when space is reconfigured during tenant improvements).

X10.2.7 Calibrate thermostats periodically to ensure they are measuring the true temperature.

X10.2.8 Temperature set points on thermostats should be set cooler in winter (for example, 68 to 70°F [20 to 21.1°C]) and warmer in summer (for example, 74 to 76°F [23.3 to 24.4°C]).

X10.2.9 Revise janitorial practices to reduce the hours that lights are turned on each day (for example, the janitorial staff can "team clean" so they only use lights in one area at a time).

X10.2.10 Maintain HVAC equipment per manufacturer recommendations (for example, boiler tune-ups, regular cleaning of filters and coils, making sure dampers are working properly).

X10.2.11 Add a purchase specification to buy energy efficient products.

X10.3 *Low-Cost Measures*:

X10.3.1 Install energy efficient lights—replace incandescent lights with ENERGY STAR-qualified compact fluorescent lamps (CFLs), cold-cathode CFLs, or light-emitting diodes (LEDs); replace T12 lamps with T8 or T5 fluorescents; replace magnetic ballasts with more efficient electronic ballasts for all fluorescent lamp fittings.

X10.3.2 Install photocells in areas with windows or skylights to decrease lighting during daylight hours.

X10.3.3 Install and use programmable thermostats.

X10.3.4 Install occupancy (motion) sensors in offices, conference rooms, restrooms, closets, maintenance areas, and elevators, and dimmable lights on motion sensors in stairwells.

X10.3.5 Seal leaks in air supply and return ducts.

X10.3.6 Insulate heating and cooling ducts, hot water lines, water heater, and storage tank.

X11. ILLUSTRATIVE EXAMPLE OF BUILDING ENERGY USE CALCULATIONS

X11.1 *Collect Building Characteristics Data*:

Building Data (see Note X11.1)

Type Property	Hotel – Suites Stand-alone Outdoor Open Parking Conference Facilities Restaurants Swimming Pool Rectangular Footprint
Height	8 Stories
Total No. of Rooms	221
Gross Floor Area, SF	204,200
Location	Mid-Atlantic
Laundry Facility	Yes
Food Facility	Yes
Operating Hours	24/7
Year Built	1986
Last Major Renovation	December 2006
Energy	Electricity/Gas
2009 Total Energy Cost	$397,811

Note X11.1—Building data is not representative of any specific property.

X11.2 *Collect Energy/Weather/Room Occupancy Data*:

Month	Electricity kWh	Electricity kWh/SF	Electricity kBtu/SF	Gas kBtu	Gas kBtu/SF	Total Energy kBtu/SF	Total Rooms	Occupied Rooms	Cooling Degree Days (*CDD*)	Heating Degree Days (*HDD*)	Occupancy (OCC)
Jan-07	209,063	1	3.5	605,031	3	6.5	6851	3481	0	912	50.8
Feb-07	209,059	1	3.5	1,116,557	5.5	9	6188	3331	0	836	53.8
Mar-07	211,788	1	3.5	1,206,672	5.9	9.4	6851	5096	0	702	74.4
Apr-07	215,893	1.1	3.6	603,398	3	6.6	6630	3972	4	315	59.9
May-07	188,236	0.9	3.1	436,616	2.1	5.3	6851	4534	23	182	66.2
Jun-07	247,489	1.2	4.1	329,071	1.6	5.7	6630	4803	264	0	72.4
Jul-07	293,952	1.4	4.9	321,271	1.6	6.5	6851	4868	402	0	71.1
Aug-07	288,745	1.4	4.8	361,576	1.8	6.6	6851	4807	237	0	70.2
Sep-07	264,510	1.3	4.4	340,565	1.7	6.1	6630	4527	147	28	68.3
Oct-07	230,297	1.1	3.8	457,108	2.2	6.1	6851	5621	4	297	82
Nov-07	202,009	1	3.4	783,791	3.8	7.2	6630	4076	0	605	61.5
Dec-07	204,232	1	3.4	1,958,623	9.6	13	6851	3749	0	900	54.7|
Jan-08	220,128	1.1	3.7	2,150,152	10.5	14.2	6851	4180	0	912	61
Feb-08	192,715	0.9	3.2	1,386,945	6.8	10	6409	3921	0	875	61.2
Mar-08	241,852	1.2	4	901,886	4.4	8.5	6851	4616	0	702	67.4
Apr-08	123,768	0.6	2.1	348,168	1.7	3.8	6630	4367	4	315	65.9|
May-08	191,081	0.9	3.2	454,846	2.2	5.4	6851	4534	23	182	66.2
Jun-08	265,434	1.3	4.4	378,486	1.9	6.3	6630	4890	264	0	73.8
Jul-08	284,622	1.4	4.8	336,525	1.6	6.4	6851	4990	402	0	72.8
Aug-08	232,655	1.1	3.9	329,932	1.6	5.5	6851	4631	237	0	67.6|
Sep-08	213,467	1	3.6	349,605	1.7	5.3	6630	4052	147	28	61.1
Oct-08	183,086	0.9	3.1	496,835	2.4	5.5	6851	4775	4	316	69.7
Nov-08	183,086	0.9	3.1	795,166	3.9	7	6630	3779	0	589	57
Dec-08	252,642	1.2	4.2	916,968	4.5	8.7	6851	3463	0	875	50.5|
Jan-09	191,427	0.9	3.2	1,157,327	5.7	8.9	6851	3071	0	1175	44.8
Feb-09	177,314	0.9	3	1,134,097	5.6	8.5	6188	3216	0	815	52
Mar-09	194,777	1	3.3	871,427	4.3	7.5	6851	3699	0	726	54
Apr-09	178,294	0.9	3	484,487	2.4	5.4	6630	3405	36	350	51.4|
May-09	259,437	1.3	4.3	476,610	2.3	6.7	6851	3047	48	103	44.5
Jun-09	276,080	1.4	4.6	308,988	1.5	6.1	6630	3703	115	21	55.9
Jul-09	257,798	1.3	4.3	260,519	1.3	5.6	6851	3737	214	0	54.5
Aug-09	271,667	1.3	4.5	281,725	1.4	5.9	6851	3885	340	0	56.7|
Sep-09	216,471	1.1	3.6	378,662	1.9	5.5	6630	4184	73	46	63.1
Oct-09	203,892	1	3.4	401,887	2	5.4	6630	4072	2	313	61.4
Nov-09	185,397	0.9	3.1	653,441	3.2	6.3	6630	4110	2	589	62
Dec-09	185,662	0.9	3.1	755,540	3.7	6.8	6851	4316	0	903	63

X11.3 *Determine actual Energy Use and EUI for time period over which data was collected*:

	2007	2008	2009
Energy Use (Million kBtu/yr)	18.0	17.7	16.1
EUI (kBtu/SF/yr)	88.0	86.5	78.6

X11.4 *Determine Building Total Energy Use Equation (Least Squares Regression Analysis)*:

$$EUI = 0\{CDD, HDD, OCC\}$$
$$EUI = 3.3749 + 0.005811(CDD) + 0.00546(HDD) + 0.01542(OCC)$$

where:
EUI = total energy use intensity (gas and electricity), kBtu/SF-month,
CDD = cooling degree days,
HDD = heating degree days, and
OCC = occupancy, %.

Note X11.2—The building *energy use equation* approach was utilized because the last 12 months of *energy use* data was judged by the *consultant* conducting the *BEPA* to not be representative, particularly due to relatively lower occupancies as a result of the recession. For example, the April and May 2009 occupancies were more than 15 % below the average occupancy level.

X11.5 *Statistical Analysis of Data*:

	OCC
25th %	54.6
Mean	61.7
75th %	68.1

	HDD 10 Year Statistics			CDD 10 Year Statistics			********EUI********		
Month	25th %	Mean	75th %	25th %	Mean	75th %	Upper	Average	Lower
Jan	912	1,099	1,243	0	0	0	11.2	10.3	9.2
Feb	887	1,079	1,195	0	0	0	10.9	10.2	9.1
Mar	693	733	744	0	0	0	8.5	8.3	8.0
Apr	315	346	383	16	27	35	6.7	6.4	6.0
May	105	138	175	26	39	46	5.6	5.3	4.9
Jun	0	7	16	167	225	270	6.1	5.7	5.2
Jul	0	0	0	308	354	402	6.8	6.4	6.0
Aug	0	0	0	307	362	409	6.8	6.4	6.0
Sep	25	32	38	82	124	156	5.5	5.2	4.8
Oct	297	317	365	9	26	43	6.7	6.2	5.9
Nov	560	591	614	0	3	5	7.8	7.6	7.3
Dec	881	990	1,078	0	3	4	10.3	9.7	9.0
						Totals	92.9	87.7	81.4

X11.6 *Determine Building EUI Range*:

Upper: 92.9 kBtu/SF-yr
Lower: 81.4 kBtu/SF-yr
Average: 87.7 kBtu/SF-yr

X11.7 *Determine Building Energy Cost Range*:

X11.7.1 Building Energy Cost Multiplier (based on last 12 months energy cost data):

$397,811/16.1 Million kBtu = $0.0247/ kBtu

X11.7.2 Building Energy Cost Range:

Upper: (92.9 kBtu/SF-yr)(204,200 SF) = 19 Million kBtu/yr
($0.0247/kBtu) = $469,300/yr
Lower: (81.4 kBtu/SF-yr)(204,200 SF) = 16.6 Million kBtu/yr
($0.0247/kBtu) = $410,560/yr
Average: (87.7 kBtu/SF-yr)(204,200 SF) = 17.9 Million kBtu/yr
($0.0247/kBtu) = $442,130/yr

X11.8 *Determine Pro Forma Building Energy Use*:

17.9 Million kBtu/yr

X11.9 *Determine Pro Forma Building Energy Use Intensity*:

87.7 kBtu/SF-yr

X11.10 *Determine Pro Forma Building Energy Cost*

$442,130 or $2.17/SF