LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

LEED

REFERENCE GUIDE FOR **INTERIOR DESIGN AND CONSTRUCTION**

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v4

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Getting Started

HOW TO USE THIS REFERENCE GUIDE

This reference guide is designed to elaborate upon and work in conjunction with the rating system. Written by expert users of LEED, it serves as a roadmap, describing the steps for meeting and documenting credit requirements and offering advice on best practices.

Within each section, information is organized to flow from general guidance to more specific tips and finally to supporting references and other information. Sections have been designed with a parallel structure to support way finding and minimize repetition.

CREDIT CATEGORIES

INTEGRATIVE PROCESS

LOCATION AND TRANSPORTATION (LT)

WATER EFFICIENCY (WE)

ENERGY AND ATMOSPHERE (EA)

MATERIALS AND RESOURCES (MR)

INDOOR ENVIRONMENTAL QUALITY (EQ)

INNOVATION (IN)

REGIONAL PRIORITY (RP)

MORE ABOUT THE FURTHER EXPLANATION SECTION

Further Explanation contains varied subsections depending on the credit; two of the common subsections are elaborated upon here.

CAMPUS PROJECTS

Campus refers to the Campus Program for Projects on a Shared Site, which certifies multiple projects located on one site and under the control of a single entity. In the ID+C context, an example would be multiple nonconsecutive floors within a single office building with similar fit-out. Only project teams using the Campus Program need to follow the guidance in the Campus section; the guidance is not applicable to projects that are in a campus setting but not pursuing certification using the Campus Program.

There are two approaches to certifying multiple projects under the Campus Program:

- **Group Approach** allows project spaces that are substantially similar and are in a single location to certify as one project that shares a single certification.
- **Campus Approach** allows project spaces that share a single location and site attributes to achieve separate LEED certification for each project space or group on the master site.

For each approach, the reference guide gives any credit-specific information and notes two possible scenarios:

- **Group Approach**
  - "All project spaces in the group may be documented as one." The project spaces may meet the credit requirements as a single group by, for example, pooling resources or purchasing, and then submitting a single set of documentation.
  - "Submit separate documentation for each project space." Each project space in the group project must meet the credit requirements individually for the project to earn the credit.
- **Campus Approach**
  - "Eligible." This credit may be documented once at the level of the master site, and then individual projects within the master site boundary earn the credit without submitting additional documentation.
  - "Ineligible. Each LEED project may pursue the credit individually." Each project space within the campus boundary may earn the credit but each project space must document compliance separately.

PROJECTS OUTSIDE THE U.S.

The *International Tips* section offers advice on determining equivalency to U.S. standards or using non-U.S. standards referenced in the rating system. It is meant to complement, not replace, the other sections of the credit. Helpful advice for projects outside the U.S. may also appear in the *Step-by-Step Guidance* section of each credit. When no tips are needed or available, the *International Tips* heading does not appear.

Units of measurement are given in both Inch-Pound (IP) and International System of Units (SI). IP refers to the system of measurements based on the inch, pound, and gallon, historically derived from the English system and commonly used in the U.S. SI is the modern metric system used in most other parts of the world and defined by the General Conference on Weights and Measures.

Where "local equivalent" is specified, it means an alternative to a LEED referenced standard that is specific to a project's locality. This standard must be widely used and accepted by industry experts and when applied, must meet the credit's intent leading to similar or better outcomes.

Where "USGBC-approved local equivalent" is specified, it means a local standard deemed equivalent to the listed standard by the U.S. Green Building Council through its process for establishing non-U.S. equivalencies in LEED.

TAKING AN INTEGRATIVE APPROACH TO DESIGN AND CONSTRUCTION

The realization of benefits associated with LEED starts with a transformation of the design process itself. Success in LEED and green building design is best accomplished through an integrative design process that prioritizes cost-effectiveness over both the short and long terms and engages all project team members in discovering beneficial interrelationships and synergies between systems and components. By integrating technical and living systems, the team can achieve high levels of building performance, human performance, and environmental benefits.[1]

Conventionally, the design and construction disciplines work separately, and their solutions to design and construction challenges are fragmented. These “solutions” often create unintended consequences—some positive, but mostly negative. The corollary is that when areas of practice are integrated, it becomes possible to significantly improve building performance and achieve synergies that yield economic, environmental, and human health benefits.

In the conventional design process, each discipline’s practitioner is expected to design the subassemblies and system components under his or her control for the most benefit and the least cost. In an integrative process, an entire team—client, designers, builders, and operators—identifies overlapping relationships, services, and redundancies among systems so that interdependencies and benefits (which otherwise would have gone unnoticed) can be exploited, thereby increasing performance and reducing costs.

To work this way requires that project teams, whose members represent various disciplines, come together so that the knowledge, analyses, and ideas from each discipline can inform and link with the systems and components of all other disciplines. In this way, LEED credits become aspects of a whole rather than separate components, and the entire design and construction team can identify the interrelationships and linked benefits across multiple LEED credits.

The coordination of building and site systems—and how they relate to the tenant space— should be addressed early, preferably before schematic design. The Integrative Process credit formally introduces this way of working into LEED so that the team members’ expertise in building and site systems can inform the performance, efficiency, and effectiveness of every system.

The strategies in the Integrative Process credit are recommended for all LEED projects because they encourage integration during early design stages, when it will be the most effective. The credit introduces an integrative process by focusing on engaging energy- and water-related research and analysis to inform early design decisions through high levels of collaboration among all project team members.

Approaching certification using an integrative process gives the project team the greatest chance of success. The process includes three phases:

- **Discovery.** The most important phase of the integrative process, discovery can be thought of as an extensive expansion of what is conventionally called predesign. A project is unlikely to meets its environmental goals cost-effectively without this discrete phase. Discovery work should take place before schematic design begins.
- **Design and construction** (**implementation**)**.** This phase begins with what is conventionally called schematic design. It resembles conventional practice but integrates all the work and collective understanding of system interactions reached during the discovery phase.
- **Occupancy, operations, and performance feedback.** This third stage focuses on preparing to measure performance and creating feedback mechanisms. Assessing performance against targets is critical for informing building operations and identifying the need for any corrective action.

Achieving economic and environmental performance requires that every issue and all team members (clients, designers, engineers, constructors, operators) be brought into the project at the earliest point, before anything is yet designed. The structure to manage this flow of people, information, and analysis is as follows:

- All project team members, representing all design and construction disciplines, gather information and data relevant to the project.
- Team members analyze their information.
- Team members participate in workshops to compare notes and identify opportunities for synergy.

This process of research, analysis, and workshops is done in an iterative cycle that refines the design solutions. In the best scenario, the research and workshops continue until the project systems are optimized, all reasonable synergies are identified, and the related strategies associated with all LEED credits are documented and implemented.

1. *Integrative Process (IP) ANSI Consensus National Standard Guide© 2.0 for Design and Construction of Sustainable Buildings and Communities (February 2, 2012), p. 4, webstore.ansi.org/RecordDetail.aspx?sku=MTS+2012%3a1.*

DEVISING A LEED WORK PLAN

It is recommended that LEED applicants follow a series of steps to certification.

STEP 1. INITIATE DISCOVERY PHASE

Begin initial research and analysis (see Integrative Process Credit). When sufficient information has been gathered, hold a goal-setting workshop to discuss findings.

STEP 2. SELECT LEED RATING SYSTEM

The LEED system comprises 21 adaptations designed to accommodate the needs of a variety of market sectors (see *Rating System Selection Guidance*). For many credits, *Further Explanation* highlights rating system and project type variations to help teams develop a successful approach.

STEP 3. CHECK MINIMUM PROGRAM REQUIREMENTS

All projects seeking certification are required to comply with the minimum program requirements (MPRs) for the applicable rating system, found in this reference guide and on the USGBC website.

STEP 4. ESTABLISH PROJECT GOALS

Prioritize strategies for certification that align with the project's context and the values of the project team, owner, or organization. Once these values are articulated, project teams will be able to select appropriate strategies and associated LEED credits to meet the goals.

The recommended method for establishing project goals is to convene a goal-setting workshop (see Integrative Process Credit) for the project team members and the owner. Understanding the owner's goals, budget, schedule, functional programmatic requirements, scope, quality, performance targets, and occupants' expectations will promote creative problem solving and encourage fruitful interaction.

To capture the most opportunities, the workshop should occur before any design work and include wide representation from the design and construction disciplines.

STEP 5. DEFINE LEED PROJECT SCOPE

Review the project's program and initial findings from the goal-setting workshop to identify the project scope. Special considerations include building or site amenities or shared facilities that may be used by project occupants.

Next, map the LEED project boundary along departmental or ownership lines. If the project boundary is not obvious because of scope of work, partial renovations, or other issues, see the minimum program requirements. Share the final project boundary decision with the entire team, since this definition affects numerous prerequisites and credits.

Finally, investigate any special certification programs that may apply based on the project's scope, such as the Volume Program or the Campus Program. If the project owner is planning multiple similar projects in different locations, Volume may be a useful program to streamline certification. If the project includes multiple project spaces in a single location, Campus may be appropriate.

STEP 6. DEVELOP LEED SCORECARD

Use the project goals to identify the credits and options that should be attempted by the team. The *Behind the Intent* sections offer insight into what each credit is intended to achieve and may help teams align goals with credits that bring value to the owner, environment, and community of the project.

This process should focus the team on those credits with the highest value for the project over the long term. Once the high-priority credits have been selected, identify related credits that reinforce the priority strategies and provide synergistic benefits.

Finally, establish the target LEED certification level (Certified, Silver, Gold, or Platinum) and identify additional credits needed to achieve it. Make sure that all prerequisites can be met and include a buffer of several points above the minimum in case of changes during design and construction.

STEP 7. CONTINUE DISCOVERY PHASE

Project team members should perform additional research and analysis as the project progresses, refining the analysis, testing alternatives, comparing notes, generating ideas in small meetings, and evaluating costs. Examples of research and analysis for energy- and water-related systems are outlined in the Integrative Process credit.

The project team should reassemble occasionally to discuss overlapping benefits and opportunities (e.g., how best to use the waste products from one system to benefit other systems). This approach encourages the discovery of new opportunities, raises new questions, and facilitates testing across disciplines.

STEP 8. CONTINUE ITERATIVE PROCESS

The above pattern of research and analysis followed by team workshops should continue until the solutions satisfy the project team and owner.

STEP 9. ASSIGN ROLES AND RESPONSIBILITIES

Select one team member to take primary responsibility for leading the group through the LEED application and documentation process. This leadership role may change from the design to the construction phase, but both the design and the construction leaders should be involved throughout the process to ensure consistency, clarity, and an integrative approach.

Cross-disciplinary team ownership of LEED credit compliance can help foster integrative design while ensuring consistent documentation across credits. On a credit-by-credit basis, assign primary and supporting roles to appropriate team members for credit achievement and documentation. Clarify responsibilities for ensuring that design decisions are accurately represented in drawings and specifications and that construction details match design documentation.

Establish regular meeting dates and develop clear communication channels to streamline the process and resolve issues quickly.

STEP 10. DEVELOP CONSISTENT DOCUMENTATION

Consistent documentation is critical to achieving LEED certification.

Data accumulated throughout the construction process, such as construction materials quantities, should be gathered and assessed at regular intervals to allow the team to track ongoing progress toward credit achievement and ensure that information is not misplaced or omitted. *Maintaining Consistency in the Application*, below, and the credit category overviews discuss the numeric values and meaning of terms that affect achievement of multiple credits within a credit category.

STEP 11. PERFORM QUALITY ASSURANCE REVIEW AND SUBMIT FOR CERTIFICATION

A quality assurance review is an essential part of the work program. A thorough quality control check can improve clarity and consistency of the project's LEED documentation, thereby avoiding errors that require time and expense to correct later in the certification process. The submission should be thoroughly proofread and checked for completeness. In particular, numeric values that appear throughout the submission (e.g., site area) must be consistent across credits.

MAINTAINING CONSISTENCY IN THE APPLICATION

Certain concepts and numeric values recur across multiple credits and credit categories and must be treated consistently throughout the submission.

INCOMPLETE SPACES

Spaces that earn LEED certification should be completed by the time they have submitted their final application for LEED certification. *Complete* means that no further work is needed and the project is ready for occupancy. For ID+C projects, spaces are considered incomplete if they do not include the furnishings, fixtures, and equipment intended for regular operations of the space. No more than 40% of the certifying gross floor area of a LEED project may consist of incomplete space. Additionally, projects that include incomplete spaces must use Appendix 2 Default Occupancy Counts to establish occupant counts for incomplete spaces.

For incomplete spaces in ID+C projects, the project team must provide supplemental documentation.

- Submit a letter of commitment, signed by the owner, indicating that the remaining incomplete spaces will satisfy the requirements of each prerequisite and credit achieved by this project if and when completed by the owner. This letter may cover the commitment in general terms and need not address each prerequisite or credit individually.
- For incomplete spaces intended to be finished by tenants (i.e., parties other than the owner), submit a set of nonbinding tenant design and construction guidelines, with a brief explanation of the project circumstances.

For prerequisites with established baselines (e.g., WE Prerequisite Indoor Water Use, EA Prerequisite Minimum Energy Performance) and the credits dependent on the calculations in the prerequisites, the proposed design must be equivalent to the baseline for the incomplete spaces. Project teams that wish to claim environmental performance or benefit beyond the baseline for incomplete spaces should provide a binding tenant sales and lease agreement for the incomplete space. This must be signed by the future tenant and include terms related to how the technical credit requirements will be carried out by the tenant. If the tenant and the owner are the same entity, a signed letter if commitment is sufficient. An unsigned or sample lease agreement is not acceptable.

PREVIOUS DEVELOPMENT

Several credits require the assessment of a piece of land to determine whether it has been previously developed, defined as follows:

previously developed altered by paving, construction, and/or land use that would typically have required regulatory permitting to have been initiated (alterations may exist now or in the past). Land that is not previously developed and landscapes altered by current or historical clearing or filling, agricultural or forestry use, or preserved natural area use are considered undeveloped land. The date of previous development permit issuance constitutes the date of previous development, but permit issuance in itself does not constitute previous development.

Tricky lands to assess include those with few buildings present. If the land previously had buildings, then it is considered previously developed even if those buildings have since been torn down. Another frequently confusing situation is parkland. Pay careful attention to the type of parkland. Improved parks with graded land and constructed features like playgrounds (e.g., a city park) are considered previously developed. Land maintained in a natural state (e.g., a forest preserve) is not considered previously developed, even if minor features like walking paths are present.

DENSITY

Density can be calculated separately for residential and nonresidential elements or as a single value. The following definitions apply:

density a ratio of building coverage on a given parcel of land to the size of that parcel. Density can be measured using floor area ratio (FAR); dwelling units per acre (DU/acre) or dwelling units per hectare (DU/hectare); square feet of building area per acre of buildable land; or square meters of building area per hectare of buildable land. It does not include structured parking.

buildable land the portion of the site where construction can occur, including land voluntarily set aside and not constructed on. When used in density calculations, buildable land excludes public rights-of-way and land excluded from development by codified law.

Land voluntarily set aside and not built on, such as open space, is considered buildable because it was available for construction but set aside voluntarily. For example, 5 acres (2 hectares) of park space required by local government code would be considered nonbuildable, but if a developer voluntarily sets aside an additional 3 acres (1.2 hectares) for more park space, those 3 acres (1.2 hectares) must be categorized as buildable land.

After determining buildable land, calculate residential or nonresidential density or a combined density. To calculate residential density, divide the number of dwelling units by the amount of residential land. To calculate nonresidential density, use floor area ratio (FAR):

floor-area ratio (**FAR**) the density of nonresidential land use, exclusive of structured parking, measured as the total nonresidential building floor area divided by the total buildable land area available for nonresidential buildings.

For example, on a site with 10,000 square feet (930 square meters) of buildable nonresidential land area, a building of 10,000 square feet (930 square meters) of floor area would have a FAR of 1.0. On the same site, a building of 5,000 square feet (465 square meters) would have a FAR of 0.5; a building of 15,000 square feet (1395 square meters) would have a FAR of 1.5; and a building of 20,000 square feet (1860 square meters) would have a FAR of 2.0.
To calculate the combined density for residential and nonresidential areas, use FAR.

OCCUPANCY

Many kinds of people use a typical LEED project space, and the mix varies by project type. Occupants are sometimes referred to in a general sense; for example, "promote occupants' comfort, well-being, and productivity by improving indoor air quality." In other instances, occupants must be counted for calculations. Definitions of occupant types are general guidelines that may be modified or superseded in a particular credit when appropriate (such changes are noted in each credit's reference guide section). Most credits group users into two categories, regular building occupants and visitors.

Regular Building Occupants

Regular building occupants are habitual users of a building. All of the following are considered regular building occupants.

Employees include part-time and full-time employees, and totals are calculated using full-time equivalency (FTE). A typical project can count FTE employees by adding full-time employees and part-time employees, adjusted for their hours of work.

EQUATION 1.

$$\text{FTE employees} = \text{Full-time employees} + (\Sigma \text{ daily part-time employee hours} / 8)$$

For buildings with more unusual occupancy patterns, calculate the FTE building occupants based on a standard eight-hour occupancy period.

EQUATION 2.

$$\text{FTE employees} = (\Sigma \text{ all employee hours} / 8)$$

Staff is synonymous with employees for the purpose of LEED calculations.

Volunteers who regularly use a building are synonymous with employees for the purpose of LEED calculations.

Residents of a project are considered regular building occupants. This includes residents of a dormitory. If actual resident count is not known, use a default equal to the number of bedrooms in the dwelling unit plus one, multiplied by the number of such dwelling units.

Primary and secondary school students are typically regular building occupants (see the exception in LT Credit Bicycle Facilities).

Hotel guests are typically considered regular building occupants, with some credit-specific exceptions. Calculate the number of overnight hotel guests based on the number and size of units in the project. Assume 1.5 occupants per guest room and multiply the resulting total by 60% (average hotel occupancy). Alternatively, the number of hotel guest occupants may be derived from actual or historical occupancy.

Inpatients are medical, surgical, maternity, specialty, and intensive-care unit patients whose length of stay exceeds 23 hours. **Peak inpatients** are the highest number of inpatients at a given point in a typical 24-hour period.

Visitors

Visitors (also "transients") intermittently use a LEED building. All of the following are considered visitors:

Retail customers are considered visitors. In Water Efficiency credits, retail customers are considered separately from other kinds of visitors and should not be included in the total average daily visitors.

Outpatients visit a hospital, clinic, or associated health care facility for diagnosis or treatment that lasts 23 hours or less.

Peak outpatients are the highest number of outpatients at a given point in a typical 24-hour period.

Volunteers who periodically use a building (e.g., once per week) are considered visitors.

Higher-education students are considered visitors to most buildings, except when they are residents of a dorm, in which case they are residents.

In calculations, occupant types are typically counted in two ways:

Daily averages take into account all the occupants of a given type for a typical 24-hour day of operation.

Peak totals are measured at the moment in a typical 24-hour period when the highest number of a given occupant type is present.

Whenever possible, use actual or predicted occupancies. If occupancy cannot be accurately predicted, one of the following resources to estimate occupancy:

a. Default occupant density from ASHRAE 62.1-2010, Table 6-1

b. Default occupant density from CEN Standard EN 15251, Table B.2

c. Appendix 2 Default Occupancy Counts

d. Results from applicable studies.

If numbers vary seasonally, use occupancy numbers that are a representative daily average over the entire operating season of the building.
If occupancy patterns are atypical (shift overlap, significant seasonal variation), explain such patterns when submitting documentation for certification.

Table 1 lists prerequisites and credits that require specific occupancy counts for calculations.

TABLE 1. Occupancy types for calculations, by project type variation

Prerequisite, credit	Regular building occupants	Average daily visitors	Peak visitors	Other	Notes
LT Credit Bicycle Facilities					
Commercial Interiors, Hospitality	X		X		
Retail	X				
WE Prerequisite and Credit Indoor Water Use					
Commercial Interiors, Hospitality, Retail	X	X			Retail customers are considered separately and not included in average daily visitors.

QUICK REFERENCE

TABLE 2. Credit Attributes

Category	Prerequisite/ Credit	Credit Name	Design/ Construction	Exemplary Performance	Points		
					Commercial Interiors	Retail	Hospitality
n/a	C	Integrative Process	D	no	2	2	2
LT Location and Transportation							
LT	C	LEED for Neighborhood Development Location	D	no	18	18	18
LT	C	Surrounding Density and Diverse Uses	D	no	8	8	8
LT	C	Access to Quality Transit	D	yes	7	7	7
LT	C	Bicycle Facilities	D	no	1	1	1
LT	C	Reduced Parking Footprint	D	yes	2	2	2
WE Water Efficiency							
WE	P	Indoor Water Use Reduction	D	no	Req	Req	Req
WE	C	Indoor Water Use Reduction	D	no	12	12	12
EA Energy and Atmosphere							
EA	P	Fundamental Commissioning and Verification	D	no	Req	Req	Req
EA	P	Minimum Energy Performance	D	no	Req	Req	Req
EA	P	Fundamental Refrigerant Management	D	no	Req	Req	Req
EA	C	Enhanced Commissioning	C	no	5	5	5
EA	C	Optimize Energy Performance	D	yes	25	25	25
EA	C	Advanced Energy Metering	D	no	2	2	2
EA	C	Renewable Energy Production	D	yes	3	3	3
EA	C	Enhanced Refrigerant Management	D	no	1	1	1
EA	C	Green Power and Carbon Offsets	C	no	2	2	2

TABLE 2. (CONTINUED) Credit Attributes

Category	Prerequisite/ Credit	Credit Name	Design/ Construction	Exemplary Performance	Points		
					Commercial Interiors	Retail	Hospitality
MR	P	Storage and Collection of Recyclables	D	no	Req	Req	Req
MR	P	Construction and Demolition Waste Management Planning	C	no	Req	Req	Req
MR	C	Long-term Commitment	C	no	1	1	1
MR	C	Interiors Life-Cycle Impact Reduction	C	yes	4	5	4
MR	C	Building Product Dislosure and Optimization—Environmental Product Declarations	C	yes	2	2	2
MR	C	Building Product Disclosure and Optimization—Sourcing of Raw Materials	C	yes	2	2	2
MR	C	Building Product Disclosure and Optimization—Material Ingredients	C	yes	2	2	2
MR	C	Construction and Demolition Waste Management	C	yes	2	2	2
EQ Indoor Environmental Quality							
EQ	P	Minimum Indoor Air Quality Performance	D	no	Req	Req	Req
EQ	P	Environmental Tobacco Smoke Control	D	no	Req	Req	Req
EQ	C	Enhanced Indoor Air Quality Strategies	D	yes	2	3	2
EQ	C	Low-Emitting Materials	C	yes	3	3	3
EQ	C	Construction Indoor Air Quality Management Plan	C	no	1	1	1
EQ	C	Indoor Air Quality Assessment	C	no	2	2	2
EQ	C	Thermal Comfort	D	no	1	1	1
EQ	C	Interior Lighting	D	no	2	2	2
EQ	C	Daylight	D	no	3	3	3
EQ	C	Quality Views	D	yes	1	1	1
EQ	C	Acoustic Performance	D	no	2	N / A	2
IN Innovation							
IN	C	Innovation		no	5	5	5
IN	C	LEED Accredited Professional		no	1	1	1
RP Regional Priority							
RP	C	Regional Priority		no	4	4	4

Minimum Program Requirements

INTRODUCTION

The Minimum Program Requirements (MPRs) are the minimum characteristics or conditions that make a project appropriate to pursue LEED certification. These requirements are foundational to all LEED projects and define the types of buildings, spaces, and neighborhoods that the LEED rating system is designed to evaluate.

1. MUST BE IN A PERMANENT LOCATION ON EXISTING LAND

INTENT

The LEED rating system is designed to evaluate buildings, spaces, and neighborhoods in the context of their surroundings. A significant portion of LEED requirements are dependent on the project's location, therefore it is important that LEED projects are evaluated as permanent structures. Locating projects on existing land is important to avoid artificial land masses that have the potential to displace and disrupt ecosystems.

REQUIREMENTS

All LEED projects must be constructed and operated on a permanent location on existing land. No project that is designed to move at any point in its lifetime may pursue LEED certification. This requirement applies to all land within the LEED project.

ADDITIONAL GUIDANCE

Permanent location

- Movable buildings are not eligible for LEED. This includes boats and mobile homes.
- Prefabricated or modular structures and building elements may be certified once permanently installed as part of the LEED project.

Existing land

- Buildings located on previously constructed docks, piers, jetties, infill, and other manufactured structures in or above water are permissible, provided that the artificial land is previously developed, such that the land once supported another building or hardscape constructed for a purpose other than the LEED project.

2. MUST USE REASONABLE LEED BOUNDARIES

INTENT

The LEED rating system is designed to evaluate buildings, spaces, or neighborhoods, and all environmental impacts associated with those projects. Defining a reasonable LEED boundary ensures that project is accurately evaluated.

REQUIREMENTS

The LEED project boundary must include all contiguous land that is associated with the project and supports its typical operations. This includes land altered as a result of construction and features used primarily by the project's occupants, such as hardscape (parking and sidewalks), septic or stormwater treatment equipment, and landscaping. The LEED boundary may not unreasonably exclude portions of the building, space, or site to give the project an advantage in complying with credit requirements. The LEED project must accurately communicate the scope of the certifying project in all promotional and descriptive materials and distinguish it from any non-certifying space.

ADDITIONAL GUIDANCE

Site

- Non-contiguous parcels of land may be included within the LEED project boundary if the parcels directly support or are associated with normal building operations of the LEED project and are accessible to the LEED project's occupants.
- Facilities (such as parking lots, bicycle storage, shower/changing facilities, and/or on-site renewable energy) that are outside of the LEED project boundary may be included in certain prerequisites and credits if they directly serve the LEED project and are not double-counted for other LEED projects. The project team must also have permission to use these facilities.

- The LEED project boundary may include other buildings.
  - If another building or structure within the LEED project boundary is ineligible for LEED certification, it may be included in the certification of the LEED project. It may also be excluded.
  - If another building within the LEED project boundary is eligible for LEED certification, it may be included in the certification if USGBC's multiple building guidance is followed. It may also be excluded.
- Projects that are phased sites with a master plan for multiple buildings must designate a LEED project boundary for each building or follow USGBC's master site guidance.
- The gross floor area of the LEED project should be no less than 2% of the gross land area within the LEED project boundary.

Building

- The LEED project should include the complete scope of work of the building or interior space.
- The LEED project can be delineated by ownership, management, lease, or party wall separation.
- Buildings or structures primarily dedicated to parking are not eligible for LEED certification. Parking that serves an eligible LEED project should be included in the certification.
- If the project consists of multiple structures physically connected only by circulation, parking or mechanical/storage rooms, it may be considered a single building for LEED purposes if the structures have programmatic dependency (spaces, not personnel, within the building cannot function independently without the other building) or architectural cohesiveness (the building was designed to appear as one building).
- An addition to an existing building may certify independently, excluding the existing building in its entirety. Alternatively, the addition and the entire existing building may certify as one project.

Interiors

- If a single entity owns, manages, or occupies an entire building and wishes to certify a renovated portion of the building that is not separated by ownership, management, lease, or party wall separation, they may do so if the project boundary includes 100% of the construction scope and is drawn at a clear, physical barrier.

Neighborhood

- The LEED neighborhood includes the land, water, and construction within the LEED project boundary.
- The LEED boundary is usually defined by the platted property line of the project, including all land and water within it.
  - Projects located on publicly owned campuses that do not have internal property lines must delineate a sphere-of-influence line to be used instead.
  - Projects may have enclaves of non-project properties that are not subject to the rating system, but cannot exceed 2% of the total project area and cannot be described as certified.
  - Projects must not contain non-contiguous parcels, but parcels can be separated by public rights-of-way.
- The project developer, which can include several property owners, should control a majority of the buildable land within the boundary, but does not have to control the entire area.

3. MUST COMPLY WITH PROJECT SIZE REQUIREMENTS

INTENT

The LEED rating system is designed to evaluate buildings, spaces, or neighborhoods of a certain size. The LEED requirements do not accurately assess the performance of projects outside of these size requirements.

REQUIREMENTS

All LEED projects must meet the size requirements listed below.

LEED BD+C and LEED O+M Rating Systems
The LEED project must include a minimum of 1,000 square feet (93 square meters) of gross floor area.

LEED ID+C Rating Systems
The LEED project must include a minimum of 250 square feet (22 square meters) of gross floor area.

LEED for Neighborhood Development Rating Systems
The LEED project should contain at least two habitable buildings and be no larger than 1500 acres.

LEED for Homes Rating Systems
The LEED project must be defined as a "dwelling unit" by all applicable codes. This requirement includes, but is not limited to, the International Residential Code stipulation that a dwelling unit must include "permanent provisions for living, sleeping, eating, cooking, and sanitation."

Rating System Selection Guidance

INTRODUCTION

This document provides guidance to help project teams select a LEED rating system. Projects are required to use the rating system that is most appropriate. However, when the decision is not clear, it is the responsibility of the project team to make a reasonable decision in selecting a rating system before registering their project. The project teams should first identify an appropriate rating system, and then determine the best adaptation. Occasionally, USGBC recognizes that an entirely inappropriate rating system has been chosen. In this case, the project team will be asked to change the designated rating system for their registered project. Please review this guidance carefully and contact USGBC if it is not clear which rating system to use.

RATING SYSTEM DESCRIPTIONS

LEED FOR BUILDING DESIGN AND CONSTRUCTION

Buildings that are new construction or major renovation. In addition, at least 60% of the project's *gross floor area* must be *complete* by the time of certification (except for LEED BD+C: Core and Shell).

- **LEED BD+C: New Construction and Major Renovation.** New construction or major renovation of buildings that do not primarily serve K-12 educational, retail, data centers, warehouses and distribution centers, hospitality, or healthcare uses. New construction also includes high-rise residential buildings 9 stories or more.
- **LEED BD+C: Core and Shell Development.** Buildings that are new construction or major renovation for the exterior shell and core mechanical, electrical, and plumbing units, but not a complete interior fit-out. LEED BD+C: Core and Shell is the appropriate rating system to use if more than 40% of the gross floor area is incomplete at the time of certification.
- **LEED BD+C: Schools.** Buildings made up of core and ancillary learning spaces on K-12 school grounds. LEED BD+C: Schools may optionally be used for higher education and non-academic buildings on school campuses.
- **LEED BD+C: Retail.** Buildings used to conduct the retail sale of consumer product goods. Includes both direct customer service areas (showroom) and preparation or storage areas that support customer service.
- **LEED BD+C: Data Centers.** Buildings specifically designed and equipped to meet the needs of high density computing equipment such as server racks, used for data storage and processing. LEED BD+C: Data Centers only addresses whole building data centers (greater than 60%).
- **LEED BD+C: Warehouses and Distribution Centers.** Buildings used to store goods, manufactured products, merchandise, raw materials, or personal belongings, such as self-storage.
- **LEED BD+C: Hospitality.** Buildings dedicated to hotels, motels, inns, or other businesses within the service industry that provide transitional or short-term lodging with or without food.
- **LEED BD+C: Healthcare.** Hospitals that operate twenty-four hours a day, seven days a week and provide inpatient medical treatment, including acute and long-term care.
- **LEED BD+C: Homes and Multifamily Lowrise.** Single-family homes and multi-family residential buildings of 1 to 3 stories. Projects 3 to 5 stories may choose the Homes rating system that corresponds to the ENERGY STAR program in which they are participating.
- **LEED BD+C: Multifamily Midrise.** Multi-family residential buildings of 4 to 8 occupiable stories above grade. The building must have 50% or more residential space. Buildings near 8 stories can inquire with USGBC about using Midrise or New Construction, if appropriate.

LEED FOR INTERIOR DESIGN AND CONSTRUCTION.

Interior spaces that are a complete interior fit-out. In addition, at least 60% of the project's gross floor area must be complete by the time of certification.

- **LEED ID+C: Commercial Interiors.** Interior spaces dedicated to functions other than retail or hospitality.
- **LEED ID+C: Retail.** Interior spaces used to conduct the retail sale of consumer product goods. Includes both direct customer service areas (showroom) and preparation or storage areas that support customer service.
- **LEED ID+C: Hospitality.** Interior spaces dedicated to hotels, motels, inns, or other businesses within the service industry that provide transitional or short-term lodging with or without food.

LEED FOR BUILDING OPERATIONS AND MAINTENANCE.

Existing buildings that are undergoing *improvement* work or little to no construction.

- **LEED O+M: Existing Buildings.** Existing buildings that do not primarily serve K-12 educational, retail, data centers, warehouses and distribution centers, or hospitality uses.
- **LEED O+M: Retail.** Existing buildings used to conduct the retail sale of consumer product goods. Includes both direct customer service areas (showroom) and preparation or storage areas that support customer service.

- **LEED O+M: Schools**. Existing buildings made up of core and ancillary learning spaces on K-12 school grounds. May also be used for higher education and non-academic buildings on school campuses.
- **LEED O+M: Hospitality.** Existing buildings dedicated to hotels, motels, inns, or other businesses within the service industry that provide transitional or short-term lodging with or without food.
- **LEED O+M: Data Centers.** Existing buildings specifically designed and equipped to meet the needs of high density computing equipment such as server racks, used for data storage and processing. LEED O+M: Data Centers only addresses whole building data centers.
- **LEED O+M: Warehouses and Distribution Centers.** Existing buildings used to store goods, manufactured products, merchandise, raw materials, or personal belongings (such as self-storage).

LEED FOR NEIGHBORHOOD DEVELOPMENT

New land development projects or redevelopment projects containing residential uses, nonresidential uses, or a mix. Projects may be at any stage of the development process, from conceptual planning through construction. It is recommended that at least 50% of total building floor area be new construction or major renovation. Buildings within the project and features in the public realm are evaluated.

- **LEED ND: Plan.** PProjects in conceptual planning or master planning phases, or under construction.
- **LEED ND: Built Project.** Completed development projects.

CHOOSING BETWEEN RATING SYSTEMS

The following 40/60 rule provides guidance for making a decision when several rating systems appear to be appropriate for a project. To use this rule, first assign a rating system to each square foot or square meter of the building. Then, choose the most appropriate rating system based on the resulting percentages.

The entire gross floor area of a LEED project must be certified under a single rating system and is subject to all prerequisites and attempted credits in that rating system, regardless of mixed construction or space usage type.

PERCENTAGE OF FLOOR AREA APPROPRIATE FOR A PARTICULAR RATING SYSTEM

<40%	40% - 60%	>60%
SHOULD NOT USE THAT RATING SYSTEM	PROJECT'S TEAM CHOICE	SHOULD USE THAT RATING SYSTEM

- If a rating system is appropriate for less than 40% of the gross floor area of a LEED project building or space, then that rating system should not be used.
- If a rating system is appropriate for more than 60% of the gross floor area of a LEED project building or space, then that rating system should be used.
- If an appropriate rating system falls between 40% and 60% of the gross floor area, project teams must independently assess their situation and decide which rating system is most applicable.

Location and Transportation (LT)

OVERVIEW

The Location and Transportation (LT) category rewards thoughtful project team decisions about the location of their tenant space, with credits that encourage compact development, alternative transportation, and connection with amenities, such as restaurants and parks. The LT category is an outgrowth of the Sustainable Sites (SS) category, which formerly covered location-related topics.

Well-located tenant spaces are those that take advantage of existing infrastructure—public transit, street networks, pedestrian paths, bicycle networks, and services and amenities. By recognizing existing patterns of development and land density, project teams can reduce strain on the environment from the social and ecological costs that accompany sprawling development patterns. In addition, the compact communities promoted by the LT credits encourage robust and realistic alternatives to private automobile use, such as walking, biking, vehicle shares, and public transit. These incremental steps can have significant benefits: a 2009 Urban Land Institute study concluded that improvements in land-use patterns and investments in public transportation infrastructure alone could reduce greenhouse gas emissions from transportation in the U.S. by 9% to 15% by 2050[1]; globally, the transportation sector is responsible for about one-quarter of energy-related greenhouse gas emissions.[2]

If integrated into the surrounding community, a well-located tenant space can also offer distinct advantages to the owner and users of the space. For owners, locating the tenant space in a vibrant, livable community makes it a destination for residents, employees, customers, and visitors. For occupants, walkable and bikable locations can enhance health by encouraging daily physical activity, and proximity to services and amenities can increase happiness and productivity.

Design strategies that complement and build on the project location are also rewarded in the LT section. For example, by limiting parking, a project can encourage building users to take alternative transportation. By providing bicycle storage, a project can support users seeking transportation options.

1. *U.S. Environmental Protection Agency, Smart Growth and Climate Change, epa.gov/dced/climatechange.htm* (*accessed September 11, 2012*).
2. *International Council on Clean Transportation, Passenger Vehicles, theicct.org/passenger-vehicles* (*accessed March 22, 2013*).

CONSISTENT DOCUMENTATION

Walking and bicycling distances are measurements of how far a pedestrian and bicyclist would travel from a point of origin to a destination, such as the nearest bus stop. This distance, also known as shortest path analysis, replaces the simple straight-line radius used in LEED 2009 and better reflects pedestrians' and bicyclists' access to amenities, taking into account safety, convenience, and obstructions to movement. This in turn better predicts the use of these amenities.

Walking distances must be measured along infrastructure that is safe and comfortable for pedestrian: sidewalks, all-weather-surface footpaths, crosswalks, or equivalent pedestrian facilities.

Bicycling distances must be measured along infrastructure that is safe and comfortable for bicyclists: on-street bicycle lanes, off-street bicycle paths or trails, and streets with low target vehicle speed. Project teams may use bicycling distance instead of walking distance to measure the proximity of bicycle storage to a bicycle network in LT Credit Bicycle Facilities.

When calculating the walking or bicycling distance, sum the continuous segments of the walking or bicycling route to determine the distance from origin to destination. A straight-line radius from the origin that does not follow pedestrian and bicyclist infrastructure will not be accepted.

Refer to specific credits to select the appropriate origin and destination points. In all cases, the origin must be accessible to all building users, and the walking or bicycling distance must not exceed the distance specified in the credit requirements.

Water Efficiency (WE)

OVERVIEW

The Water Efficiency (WE) section addresses water holistically, looking at indoor use, outdoor use, specialized uses, and metering. The section is based on an "efficiency first" approach to water conservation. As a result, each prerequisite looks at water efficiency and reductions in potable water use alone. Then, the WE credits additionally recognize the use of nonpotable and alternative sources of water.

The conservation and creative reuse of water are important because only 3% of Earth's water is fresh water, and of that, slightly over two-thirds is trapped in glaciers.[1] Typically, most of a building's water cycles through the building and then flows off-site as wastewater. In developed nations, potable water often comes from a public water supply system far from the building site, and wastewater leaving the site must be piped to a processing plant, after which it is discharged into a distant water body. This pass-through system reduces streamflow in rivers and depletes fresh water aquifers, causing water tables to drop and wells to go dry. In 60% of European cities with more than 100,000 people, groundwater is being used faster than it can be replenished.[2]

In addition, the energy required to treat water for drinking, transport it to and from a building, and treat it for disposal represents a significant amount of energy use not captured by a building's utility meter. Research in California shows that roughly 19% of all energy used in this U.S. state is consumed by water treatment and pumping.[3]

In the U.S., buildings account for 13.6% of potable water use,[4] the third-largest category, behind thermoelectric power and irrigation. Designers and builders can construct green buildings that use significantly less water than conventional construction by incorporating native landscapes that eliminate the need for irrigation, installing water-efficient fixtures, and reusing wastewater for nonpotable water needs. The Green Building Market Impact Report 2009 found that LEED projects were responsible for saving an aggregate 1.2 trillion gallons (4.54 trillion liters) of water.[5] LEED's WE credits encourage project teams to take advantage of every opportunity to significantly reduce total water use.

1. *U.S. Environmental Protection Agency, Water Trivia Facts, water.epa.gov/learn/kids/drinkingwater/water_trivia_facts.cfm* (accessed September 12, 2012).
2. *Statistics: Graphs & Maps, UN Water, http://www.unwater.org/statistics_use.html* (accessed March 8, 2013).
3. *energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF.*
4. *USGBC, Green Building Facts, http://www.usgbc.org/articles/green-building-facts.*
5. *Green Outlook 2011, Green Trends Driving Growth* (McGraw-Hill Construction, 2010), *aiacc.org/wp-content/uploads/2011/06/greenoutlook2011.pdf* (accessed September 12, 2012).

CROSS-CUTTING ISSUES

The focus of the interiors version of the WE category is indoor water for fixtures, appliances, and processes. Several kinds of documentation span these components, depending on the project's specific water-saving strategies.

Floor plans. Floorplans are used to document the location of fixtures, appliances, and process water equipment (e.g., cooling towers, evaporative condensers), as well as submeters.

Fixture cutsheets. Projects must document their fixtures (and appliances as applicable) using fixture cutsheets or manufacturers' literature. This documentation is used in the Indoor Water Use Reduction prerequisite and credit.

Occupancy calculations. The Indoor Water Use Reduction prerequisite and credit require projections based on occupants' usage. The Location and Transportation credit category also uses project occupancy calculations. Review the occupancy section in *Getting Started* to understand how occupants are classified and counted. Also see WE Prerequisite Indoor Water Use Reduction for additional guidance specific to the WE section.

Energy and Atmosphere (EA)

OVERVIEW

The Energy and Atmosphere (EA) category approaches energy from a holistic perspective, addressing energy demand reduction, energy-efficient design strategies, and renewable energy sources.

The current worldwide mix of energy resources is weighted heavily toward oil, coal, and natural gas.[1] In addition to emitting greenhouse gases, these resources are nonrenewable: their quantities are limited or they cannot be replaced as fast as they are consumed.[2] Though estimates regarding the remaining quantity of these resources vary, it is clear that the current reliance on nonrenewable energy sources is not sustainable and involves increasingly destructive extraction processes, uncertain supplies, escalating market prices, and national security vulnerability. Accounting for approximately 40% of the total energy used today,[3] buildings are significant contributors to these problems.

Energy efficiency in a green building starts with a focus on design that reduces overall energy needs, such as building orientation and glazing selection, and the choice of climate-appropriate building materials. Strategies such as passive heating and cooling, natural ventilation, and high-efficiency HVAC systems partnered with smart controls further reduce a building's energy use. Interior Design and Construction projects can encourage these methods by choosing to locate in buildings that have been designed with efficiency in mind and then continuing the process through actions such as installing efficient lighting and appliances. The generation of renewables on the project site or purchase of green power allows portions of the remaining energy consumption to be met with non–fossil fuel energy, helping to balance the demand on traditional sources.

The commissioning process is critical to ensuring high-performing buildings. Early involvement of a commissioning authority helps prevent long-term maintenance issues and wasted energy by verifying that the design meets the owner's project requirements and functions as intended. In an operationally effective and efficient building, the staff understands what systems are installed and how they function.

The American Physical Society has found that if current and emerging cost-effective energy efficiency measures are employed in new buildings and in existing buildings as their heating, cooling, lighting, and other equipment is

1. *iea.org/publications/freepublications/publication/kwes.pdf*
2. *cnx.org/content/m16730/latest/*
3. *unep.org/sbci/pdfs/SBCI-BCCSummary.pdf*

replaced, the growth in energy demand from the building sector could fall from a projected 30% increase to zero between now and 2030.[4] The EA section supports the goal of reduced energy demand through credits related to reducing usage, designing for efficiency, and supplementing the energy supply with renewables.

4. *Energy Future: Think Efficiency* (*American Physical Society, September 2008*), *aps.org/energyefficiencyreport/report/energy-bldgs.pdf* (*accessed September 13, 2012*).

Materials and Resources (MR)

OVERVIEW

The Materials and Resources (MR) credit category focuses on minimizing the embodied energy and impacts associated with the extraction, processing, transport, maintenance, and disposal of building materials. The requirements are designed to support a life-cycle approach that improves performance and promotes resource efficiency. Each requirement identifies a specific action that fits into the larger context of a life-cycle approach to embodied impact reduction.

THE WASTE HIERARCHY

Construction and demolition waste constitutes about 40% of the total solid waste stream in the United States[1] and about 25% of the total waste stream in the European Union.[2] In its solid waste management hierarchy, the U.S. Environmental Protection Agency (EPA) ranks source reduction, reuse, recycling, and waste to energy as the four preferred strategies for reducing waste. The MR section directly addresses each of these recommended strategies.

Source reduction appears at the top of the hierarchy because it avoids environmental harms throughout a material's life cycle, from supply chain and use to recycling and waste disposal. Source reduction encourages the use of innovative construction strategies, such as prefabrication and designing to dimensional construction materials, thereby minimizing material cutoffs and inefficiencies.

Building and material reuse is the next most effective strategy because reusing existing materials avoids the environmental burden of the manufacturing process. Replacing existing materials with new ones would entail production and transportation of new materials, and it would take many years to offset the associated greenhouse gases through increased efficiency of the building. LEED has consistently rewarded the reuse of materials. LEED v4 now offers more flexibility and rewards all material reuse achieved by a project—both in situ, as part of a building reuse strategy, and from off site, as part of a salvaging strategy.

1. *U.S. Environmental Protection Agency, epa.gov/osw/conserve/rrr/imr/cdm/pubs/cd-meas.pdf.*
2. *European Commission Service Contract on Management of Construction and Demolition Waste, Final Report, http://www.eu-smr.eu/cdw/docs/BIO_Construction%20and%20Demolition%20Waste_Final%20report_09022011.pdf (accessed April 9, 2013).*

Recycling is the most common way to divert waste from landfills. In conventional practice, most waste is landfilled—an increasingly unsustainable solution. In urban areas landfill space is reaching capacity, requiring the conversion of more land elsewhere and raising the transportation costs of waste. Innovations in recycling technology improve sorting and processing to supply raw material to secondary markets, keeping those materials in the production stream longer.

Because secondary markets do not exist for every material, the next most beneficial use of waste materials is conversion to energy. Many countries are lessening the burden on landfills through a waste-to-energy solution. In countries such as Sweden and Saudi Arabia, waste-to-energy facilities are far more common than landfills. When strict air quality control measures are enforced, waste-to-energy can be a viable alternative to extracting fossil fuels to produce energy.

In aggregate, LEED projects are responsible for diverting more than 80 million tons (72.6 million tonnes) of waste from landfills, and this volume is expected to grow to 540 million tons (489.9 million tonnes) by 2030.[3] From 2000 to 2011, LEED projects in Seattle diverted an average of 90% of their construction waste from the landfill, resulting in 175,000 tons (158 757.3 tonnes) of waste diverted.[4] If all newly constructed buildings achieved the 90% diversion rate demonstrated by Seattle's 102 LEED projects, the result would be staggering. Construction debris is no longer waste, it is a resource.

LIFE-CYCLE ASSESSMENT IN LEED

Through credits in the MR category, LEED has instigated market transformation of building products by creating a cycle of consumer demand and industry delivery of environmentally preferable products. LEED project teams have created demand for increasingly sustainable products; in turn, suppliers, designers, and manufacturers are responding. From responsibly harvested wood to recycled content to biobased materials, the increased supply of sustainable materials has been measurable over the history of LEED. Several MR credits reward use of products that perform well on specific criteria. It is difficult, however, to compare two products that have different sustainable attributes—for example, cabinets made of wheat husks sourced from all over the country and bound together in resin versus solid wood cabinets made from local timber. Life-cycle assessment (LCA) provides a more comprehensive picture of materials and products, enabling project teams to make more informed decisions that will have greater overall benefit for the environmental, human health, and communities, while encouraging manufacturers to improve their products through innovation.

LCA is a "compilation and evaluation of the inputs and outputs and the potential environmental impacts of a product system throughout its life cycle."[5] The entire life cycle of a product (or building) is examined, the processes and constituents identified, and their environmental effects assessed—both upstream, from the point of manufacture or raw materials extraction, and downstream, including transportation, use, maintenance, and end of life. This approach is sometimes called "cradle to grave." Going even further, "cradle to cradle" emphasizes recycling and reuse at the end of life rather than disposal.

Life-cycle approaches to materials assessment began in the 1960s with carbon accounting models. Since then, LCA standards and practices have been developed and refined. In Europe and a few other parts of the world, manufacturers, regulators, specifiers, and consumers in many fields have been using life-cycle information to improve their product selections and product environmental profiles. Until relatively recently, however, the data and tools that support LCA were lacking in the U.S. Now a growing number of manufacturers are ready to document and publicly disclose the environmental profiles of their products, and programs that assist this effort and help users understand the results are available.

LEED aims to accelerate the use of LCA tools and LCA-based decision making, thereby spurring market transformation and improving the quality of databases. Recognizing the limitations of the life-cycle approach for addressing human health and the ecosystem consequences of raw material extraction, LEED uses alternative, complementary approaches to LCA in the credits that address those topics.

3. *USGBC, Green Building Facts, USGBC, usgbc.org/ShowFile.aspx?DocumentID=18693 (accessed September 13, 2012).*
4. *City of Seattle, LEED Projects Analysis, seattle.gov/dpd/greenbuilding/docs/dpdp022009.pdf (accessed March 26, 2013).*
5. *ISO 14040 International Standard, Environmental management, Life cycle assessment, principles and framework (Geneva, Switzerland: International Organization for Standardization, 2006).*

CROSS-CUTTING ISSUES

Required Products and Materials

The scope of the MR credit category includes the building or portions of the building that are being constructed or renovated. Portions of an existing building that are not part of the construction contract are excluded from MR documentation unless otherwise noted. For guidance on the treatment of additions, see the minimum program requirements.

Qualifying Products and Exclusions

The MR section for interior design and construction includes permanently installed building products as well as furniture. "Permanently installed building products" is defined by LEED as the products and materials that create the building or are attached to it. Examples include structure and enclosure elements, installed finishes, framing, interior walls, cabinets and casework, doors, and roofs. Most of these materials fall into Construction Specifications Institute (CSI) 2012 MasterFormat Divisions 3-10, 31, and 32. Some products addressed by MR credits fall outside these divisions. Furniture items within the project's scope of work are also required to be included in credit calculations.

In past versions of LEED, all mechanical, electrical, and plumbing (MEP) equipment, categorized as CSI MasterFormat divisions 11, 21-28, and other specialty divisions, was excluded from MR credits. In this version of LEED, some specific products that are part of these systems but are "passive" (meaning not part of the active portions of the system) may be included in credit calculations. This allows flexibility for the optional assessment of piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, faucets, showerheads, and lamp housings. If they are included in credit calculations, they must be included consistently across relevant MR credits. However, if some of these products are included in credit calculations, not all products of that type must be included. For example, if the cost of ducts is included in the MR calculations for recycled content, the cost of ducts that do not meet the credit requirement does not need to be included in the numerator or denominator of credit calculations. However, the denominator for cost-based credits (all Building Product Disclosure and Optimization credits) calculations must be the same.

Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, are excluded from the credit calculations. Also exclude products purchased for temporary use on the project, like formwork for concrete.

Defining a Product

Several credits in this category calculate achievement on the basis of number of products instead of product cost. For these credits, a "product" or a "permanently installed building product" is defined by its function in the project. A product includes the physical components and services needed to serve the intended function. If there are similar products within a specification, each contributes as a separate product. Here are a few scenarios.

Products that arrive at the project site ready for installation:

- Metal studs, wallboard, and concrete masonry units are all separate products.
- For wallboard, the gypsum, binder, and backing are all required for the product to function, so each ingredient does not count as a separate product.

Products that arrive as an ingredient or component used in a site-assembled product:

- Concrete admixtures are considered separate products because each component (admixture, aggregate, and cement) serves a different function; each component is therefore a separate product.

Similar products from the same manufacturer with distinct formulations versus similar products from the same manufacturer with aesthetic variations or reconfigurations:

- Paints of different gloss levels are separate products because each paint type is specified to serve a different function, such as water resistance. Different colors of the same paint are not separate products because they serve the same function.
- Carpets of different pile heights are separate products because they are used for different kinds of foot traffic. The same carpet in a different color is not a separate product.
- Desk chairs and side chairs in the same product line are different products because they serve different functions. Two side chairs differing only in aesthetic aspects, such as the presence of arms, are not different products.

Determining Product Cost

Product and materials cost includes all expenses to deliver the material to the project site. Materials cost should include all taxes and delivery costs incurred by the contractor but exclude any cost for labor and equipment after the material is delivered to the site.

The Building Design and Construction (BD+C) rating systems use a default materials cost calculation. This approach is not applicable to Interior Design and Construction (ID+C) rating systems.

Location Valuation Factor

Several credits in the MR section include a location valuation factor, which adds value to locally produced products and materials. The intent is to incentivize the purchase of products that support the local economy. Products and materials that are extracted, manufactured, and purchased within 100 miles (160 kilometers) of the project are valued at 200% of their cost (i.e., the valuation factor is 2).

For a product to qualify for the location valuation factor, it must meet two conditions: all extraction, manufacture, and purchase (including distribution) of the product and its materials must occur within that radius (Figure 1), and the product (or portion of an assembled product) must meet at least one of the sustainable criteria (e.g., FSC certification, recycled content) specified in the credit. Products and materials that do not meet the location radius but do meet at least one of the sustainability criteria are valued 100% of their cost (i.e., the valuation factor is 1).

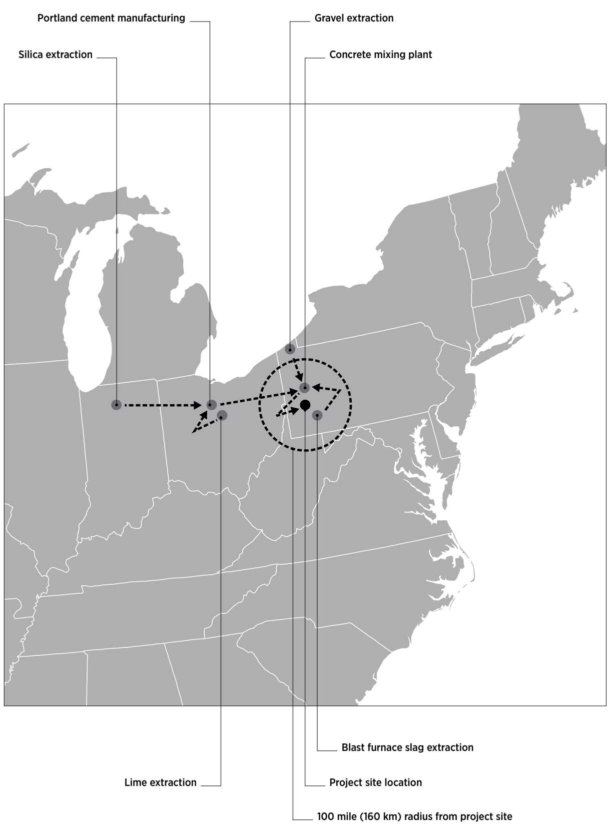

Figure 1. Example material radius

The distance is measured as the crow flies, not by actual travel distance. The point of purchase is considered the location of the purchase transaction. For online or other transactions that do not occur in person, the point of purchase is considered the location of product distribution.

For the location valuation factor of salvaged and reused materials, see MR Credit Building Product Disclosure and Optimization—Sourcing of Raw Materials, *Further Explanation, Material Reuse Considerations*.

Determining Material Contributions of an Assembly

Many sustainability criteria in the MR category apply to the entire product, as is the case for product certifications and programs. However, some criteria apply to only a portion of the product. The portion of the product that contributes to the credit could be either a percentage of a homogeneous material or the percentage of qualifying components that are mechanically or permanently fastened together. In either case, the contributing value is based on weight. Examples of homogeneous materials include composite flooring, ceiling tiles, and rubber wall base. Examples of assemblies (parts mechanically or permanently fastened together) include office chairs, demountable partition walls, premade window assemblies, and doors.

Calculate the value that contributes toward credit compliance as the percentage, by weight, of the material or component that meets the criteria, multiplied by the total product cost (Figure 2, Table 1).

Product value ($) = Total product cost ($) x (%) product component by weight x (%) meeting sustainable criteria

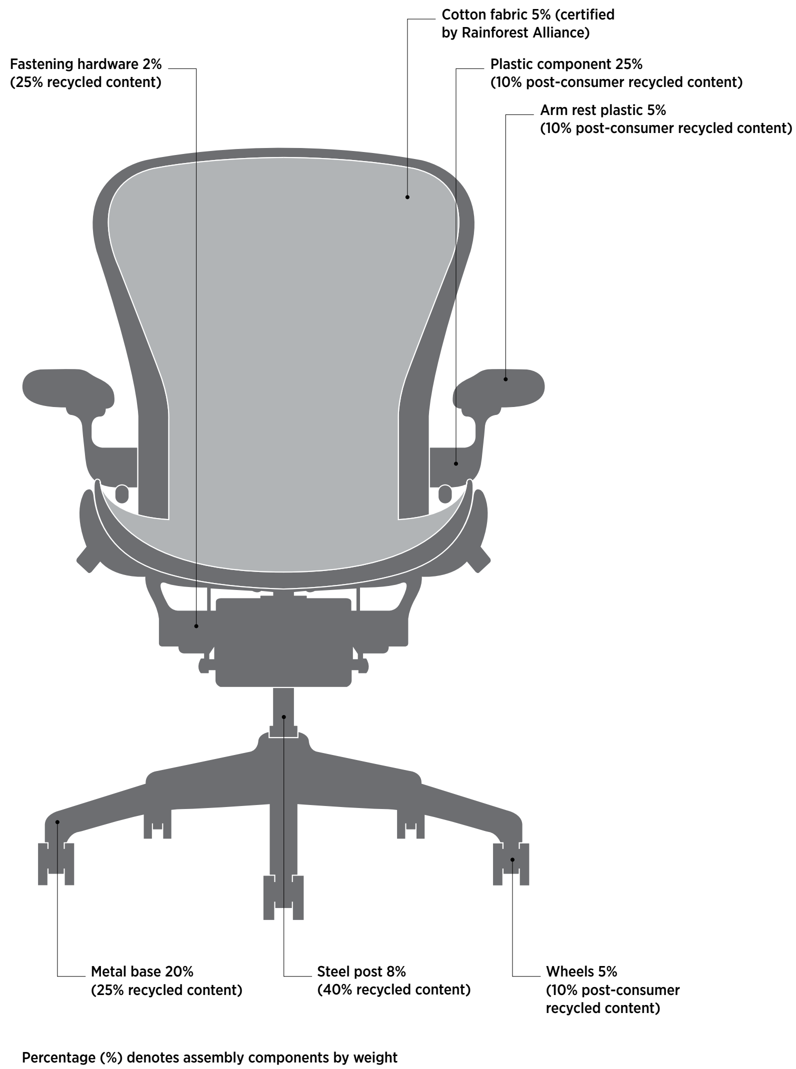

Figure 2. Sustainably produced components of $500 office chair

TABLE 1. Example calculation for $500 office chair

Chair component	Percentage of product, by weight	Value of component	Percentage of component meeting sustainability criteria	Value of sustainability criteria
Fastening hardware	2%	$10	25% preconsumer recycled content	$2.50
Cotton fabric	5%	$25	100% certified by Rainforest Alliance	$25.00
Plastic component	25%	$125	10% postconsumer recycled content	$12.50
Armrest	5%	$25	10% postconsumer recycled content	$2.50
Metal base	20%	$100	25% preconsumer recycled content	$25.00
Steel post	8%	$40	40% preconsumer recycled content	$16.00
Wheels	5%	$25	5% postconsumer recycled content	$1.25
Total value contributing to credit				**$84.75**

Indoor Environmental Quality (EQ)

OVERVIEW

The Indoor Environmental Quality (EQ) category rewards decisions made by project teams about indoor air quality and thermal, visual, and acoustic comfort. Green buildings with good indoor environmental quality protect the health and comfort of building occupants. High-quality indoor environments also enhance productivity, decrease absenteeism, improve the building's value, and reduce liability for building designers and owners.[1] This category addresses the myriad design strategies and environmental factors—air quality, lighting quality, acoustic design, control over one's surroundings—that influence the way people learn, work, and live.

The relationship between the indoor environment and the health and comfort of building occupants is complex and still not fully understood. Local customs and expectations, occupants' activities, and the building's site, design, and construction are just a few of the variables that make it difficult to quantify and measure the direct effect of a building on its occupants.[2] Therefore, the EQ section balances the need for prescriptive measures with more performance-oriented credit requirements. For example, source control is addressed first, in a prerequisite, and a later credit then specifies an indoor air quality assessment to measure the actual outcome of those strategies.

The EQ category combines traditional approaches, such as ventilation and thermal control, with emerging design strategies, including a holistic, emissions-based approach (Low-Emitting Materials credit), source control and monitoring for user-determined contaminants (Enhanced Indoor Air Quality Strategies credit), requirements for lighting quality (Interior Lighting credit), and advanced lighting metrics (Daylight credit). A new credit covering acoustics is now available.

1. *U.S. Environmental Protection Agency, Health Buildings Healthy People: A Vision for the 21st Century, epa.gov/iaq/pubs/hbhp.html* (October 2001) (*accessed July 25, 2013*).
2. *Mitchell, Clifford S., Junfeng Zhang, Torben Sigsgaard, Matti Jantunen, Palu J. Lioy, Robert Samson, and Meryl H. Karol, Current State of the Science: Health Effects and Indoor Environmental Quality, Environmental Health Perspectives 115*(6) (*June 2007*).

CROSS-CUTTING ISSUES

FLOOR AREA CALCULATIONS AND FLOOR PLANS

For many of the credits in the EQ category, compliance is based on the percentage of floor area that meets the credit requirements. In general, floor areas and space categorization should be consistent across EQ credits. Any excluded spaces or discrepancies in floor area values should be explained and highlighted in the documentation. See *Space Categorization*, below, for additional information on which floor area should be included in which credits.

SPACE CATEGORIZATION

The EQ category focuses on the interaction between the occupants of the building and the indoor spaces in which they spend their time. For this reason, it is important to identify which spaces are used by the occupants, including any visitors (transients), and what activities they perform in each space. Depending on the space categorization, the credit requirements may or may not apply (Table 1).

Occupied versus unoccupied space

All spaces in a building must be categorized as either occupied or unoccupied. Occupied spaces are enclosed areas intended for human activities. Unoccupied spaces are places intended primarily for other purposes; they are occupied only occasionally and for short periods of time—in other words, they are inactive areas.

Examples of spaces that are typically unoccupied include the following:

- Mechanical and electrical rooms
- Egress stairway or dedicated emergency exit corridor
- Closets in a residence (but a walk-in closet is occupied)
- Data center floor area, including a raised floor area
- Inactive storage area in a warehouse or distribution center

For areas with equipment retrieval, the space is unoccupied only if the retrieval is occasional.

Regularly versus nonregularly occupied spaces

Occupied spaces are further classified as regularly occupied or nonregularly occupied, based on the duration of the occupancy. Regularly occupied spaces are enclosed areas where people normally spend time, defined as more than one hour of continuous occupancy per person per day, on average; the occupants may be seated or standing as they work, study, or perform other activities. For spaces that are not used daily, the classification should be based on the time a typical occupant spends in the space when it is in use. For example, a computer workstation may be largely vacant throughout the month, but when it is occupied, a worker spends one to five hours there. It would then be considered regularly occupied because that length of time is sufficient to affect the person's well-being, and he or she would have an expectation of thermal comfort and control over the environment.

Occupied spaces that do not meet the definition of regularly occupied are nonregularly occupied; these are areas that people pass through or areas used an average of less than one hour per person per day.

Examples of regularly occupied spaces include the following:

- Airplane hangar
- Auditorium
- Auto service bay
- Bank teller station
- Conference room
- Correctional facility cell or day room
- Data center network operations center
- Data center security operations center
- Dorm room
- Exhibition hall
- Facilities staff office
- Facilities staff workstation
- Food service facility dining area
- Food service facility kitchen area
- Gymnasium
- Hospital autopsy and morgue
- Hospital critical-care area
- Hospital dialysis and infusion area
- Hospital exam room
- Hospital operating room
- Hospital patient room
- Hospital recovery area
- Hospital staff room
- Hospital surgical suite
- Hospital waiting room
- Hospital diagnostic and treatment area
- Hospital laboratory
- Hospital nursing station
- Hospital solarium
- Hospital waiting room
- Hotel front desk
- Hotel guest room
- Hotel housekeeping area
- Hotel lobby
- Information desk
- Meeting room
- Natatorium
- Open-office workstation
- Private office
- Reception desk
- Residential bedroom
- Residential dining room
- Residential kitchen
- Residential living room
- Residential office, den, workroom
- Retail merchandise area and associated circulation
- Retail sales transaction area
- School classroom
- School media center
- School student activity room
- School study hall
- Shipping and receiving office
- Study carrel
- Warehouse materials-handling area

Examples of nonregularly occupied spaces include the following:

- Break room
- Circulation space
- Copy room
- Corridor
- Fire station apparatus bay
- Hospital linen area
- Hospital medical record area
- Hospital patient room bathroom
- Hospital short-term charting space
- Hospital prep and cleanup area in surgical suite
- Interrogation room
- Lobby (except hotel lobby)*
- Locker room
- Residential bathroom
- Residential laundry area
- Residential walk-in closet
- Restroom
- Retail fitting area
- Retail stock room
- Shooting range
- Stairway

**Hotel lobbies are considered regularly occupied because people often congregate, work on laptops, and spend more time there than they do in an office building lobby.*

Occupied space subcategories

Occupied spaces, or portions of an occupied space, are further categorized as individual or shared multioccupant, based on the number of occupants and their activities. An individual occupant space is an area where someone performs distinct tasks. A shared multioccupant space is a place of congregation or a place where people pursue overlapping or collaborative tasks. Occupied spaces that are not regularly occupied or not used for distinct or collaborative tasks are neither individual occupant nor shared multioccupant spaces.

Examples of individual occupant spaces include the following:

- Bank teller station
- Correctional facility cell or day room
- Data center staff workstation
- Hospital nursing station
- Hospital patient room
- Hotel guest room
- Medical office
- Military barracks with personal workspaces
- Open-office workstation
- Private office
- Reception desk
- Residential bedroom
- Study carrel

Examples of shared multioccupant spaces include the following:

- Active warehouse and storage
- Airplane hangar
- Auditorium
- Auto service bay
- Conference room
- Correctional facility cell or day room
- Data center network operations center
- Data center security operations center
- Exhibition hall
- Facilities staff office
- Food service facility dining area
- Food service facility kitchen area
- Gymnasium
- Hospital autopsy and morgue
- Hospital critical-care area
- Hospital dialysis and infusion area
- Hospital exam room
- Hospital operating room
- Hospital surgical suite
- Hospital waiting room
- Hospital diagnostic and treatment area
- Hospital laboratory
- Hospital solarium
- Hotel front desk
- Hotel housekeeping area
- Hotel lobby
- Meeting room
- Natatorium
- Retail merchandise area and associated circulation
- Retail sales transaction area
- School classroom
- School media center
- School student activity room
- School study hall
- Shipping and receiving office
- Warehouse materials-handling area

Occupied spaces can also be classified as densely or nondensely occupied, based on the concentration of occupants in the space. A densely occupied space has a design occupant density of 25 people or more per 1,000 square feet (93 square meters), or 40 square feet (3.7 square meters) or less per person. Occupied spaces with a lower density are nondensely occupied.

Table 1 outlines the relationship between the EQ credits and the space categorization terms. If the credit is listed, the space must meet the requirements of the credit.

TABLE 1. Space types in EQ credits

Space Category	Prerequisite or Credit
Occupied space	• Minimum Indoor Air Quality Performance, ventilation rate procedure and natural ventilation procedure • Minimum Indoor Air Quality Performance, monitoring requirements • Enhanced Indoor Air Quality Strategies, Option 1 C • Enhanced Indoor Air Quality Strategies, Option 1 D • Enhanced Indoor Air Quality Strategies, Option 1 E • Enhanced Indoor Air Quality Strategies, Option 2 B • Enhanced Indoor Air Quality Strategies, Option 2 E • Indoor Air Quality Assessment, Option 2, Air Testing (sampling must be representative of all occupied spaces) • Thermal Comfort, design requirements • Acoustic Performance (CI, Hospitality)
Regularly occupied space	• Interior Lighting, Option 2, strategy A • Interior Lighting, Option 2, strategy D • Interior Lighting, Option 2, strategy E • Interior Lighting, Option 2, strategy G • Interior Lighting, Option 2, strategy H • Daylight • Quality Views
Individual occupant space	• Thermal Comfort, control requirements • Interior Lighting, Option 1
Shared multioccupant space	• Thermal Comfort, control requirements • Interior Lighting, Option 1
Densely occupied space	• Enhanced Indoor Air Quality Strategies, Option 2 C

Table 2 outlines the relationship between the EQ credits and the space categorization terms specific to each rating system (see Definitions). Unless otherwise stated, if the credit is listed, the space must meet the requirements of the credit.

TABLE 2. Rating system–specific space classifications

Rating system	Space type	Prerequisite or Credit
Hospitality	Guest rooms	• Interior Lighting* • Thermal Comfort, control requirements*
Retail	Office and administrative areas	• Thermal Comfort, control requirements • Interior Lighting, Option 2

*Hotel guest rooms are excluded from the credit requirements.

The following credits are not affected by space classifications:

- Environmental Tobacco Smoke Control
- Enhanced Indoor Air Quality Strategies, Option 1 A
- Enhanced Indoor Air Quality Strategies, Option 1 B
- Enhanced Indoor Air Quality Strategies, Option 2 A
- Enhanced Indoor Air Quality Strategies, Option 2 D (no specific spaces; applicable spaces are determined by the project team)
- Low-Emitting Materials
- Construction Indoor Air Quality Management Plan
- Indoor Air Quality Assessment, Option 1, Flush-Out (the floor area from all spaces must be included in calculation for total air volume; the flush-out must be demonstrated at the system level)
- Interior Lighting, Option 2, strategy B
- Interior Lighting, Option 2, strategy C
- Interior Lighting, Option 2, strategy F

TRICKY SPACES

Pay extra attention to how the following types of spaces are classified in specific credits.

Residential

- See the *Project Type Variations* sections in Thermal Comfort and Interior Lighting for guidance on providing appropriate controllability in residential buildings.

Auditoriums

- Exceptions to Daylight and Quality Views are permitted. See the *Project Type Variations* sections in Daylight and Quality Views.

Gymnasiums

- See the *Project Type Variations* section in Thermal Comfort for guidance on dealing with high levels of physical activity.
- Exceptions to Quality Views are permitted. See the *Project Type Variations* section in Quality Views.

Transportation Terminals

- For Thermal Comfort and Interior Lighting, Option 1, Lighting Control, most of the areas in a transportation terminal can be considered shared multioccupant. Most areas in transportation terminals are also regularly occupied.

Dormitories and Military Barracks

- These spaces fall in-between a work space and residence.
- Dorm rooms or military barracks with personal workspaces are considered individual occupant spaces. Military barracks without personal workspaces are considered shared multioccupant.

Industrial Facilities

- For Thermal Comfort and Interior Lighting, Option 1, Lighting Control, most of the active warehouse and storage areas are considered multioccupant.
- Most areas in industrial facilities are also regularly occupied.

Innovation (IN)

OVERVIEW

Sustainable design strategies and measures are constantly evolving and improving. New technologies are continually introduced to the marketplace, and up-to-date scientific research influences building design strategies. The purpose of this LEED category is to recognize projects for innovative building features and sustainable building practices and strategies.

Occasionally, a strategy results in building performance that greatly exceeds what is required in an existing LEED credit. Other strategies may not be addressed by any LEED prerequisite or credit but warrant consideration for their sustainability benefits. In addition, LEED is most effectively implemented as part of a cohesive team, and this category addresses the role of a LEED Accredited Professional in facilitating that process.

Regional Priority (RP)

OVERVIEW

Because some environmental issues are particular to a locale, volunteers from USGBC chapters and the LEED International Roundtable have identified distinct environmental priorities within their areas and the credits that address those issues. These Regional Priority credits encourage project teams to focus on their local environmental priorities.

USGBC established a process that identified six RP credits for every location and every rating system within chapter or country boundaries. Participants were asked to determine which environmental issues were most salient in their chapter area or country. The issues could be naturally occurring (e.g., water shortages) or man-made (e.g., polluted watersheds) and could reflect environmental concerns (e.g., water shortages) or environmental assets (e.g., abundant sunlight). The areas, or zones, were defined by a combination of priority issues—for example, an urban area with an impaired watershed versus an urban area with an intact watershed.

The participants then prioritized credits to address the important issues of given locations. Because each LEED project type (e.g., a data center) may be associated with different environmental impacts, each rating system has its own RP credits.

The ultimate goal of RP credits is to enhance the ability of LEED project teams to address critical environmental issues across the country and around the world.

APPENDICES

APPENDIX 1. USE TYPES AND CATEGORIES

TABLE 1. Use Types and Categories

Category	Use type
Food retail	Supermarket
	Grocery with produce section
Community-serving retail	Convenience store
	Farmers market
	Hardware store
	Pharmacy
	Other retail
Services	Bank
	Family entertainment venue (e.g., theater, sports)
	Gym, health club, exercise studio
	Hair care
	Laundry, dry cleaner
	Restaurant, café, diner (excluding those with only drive-thru service)
Civic and community facilities	Adult or senior care (licensed)
	Child care (licensed)
	Community or recreation center
	Cultural arts facility (museum, performing arts)
	Education facility (e.g., K—12 school, university, adult education center, vocational school, community college)
	Government office that serves public on-site
	Medical clinic or office that treats patients
	Place of worship
	Police or fire station
	Post office
	Public library
	Public park
	Social services center
Community anchor uses (BD+C and ID+C only)	Commercial office (100 or more full-time equivalent jobs)

Adapted from Criterion Planners, INDEX neighborhood completeness indicator, 2005.

APPENDIX 2. DEFAULT OCCUPANCY COUNTS

Use Table 1 to calculate default occupancy counts. Only use the occupancy estimates if occupancy is unknown.

For the calculation, use gross floor area, not net or leasable floor area. Gross floor area is defined as the sum of all areas on all floors of a building included within the outside faces of the exterior wall, including common areas, mechanical spaces, circulation areas, and all floor penetrations that connect one floor to another. To determine gross floor area, multiply the building footprint (in square feet or square meters) by the number of floors in the building. Exclude underground or structured parking from the calculation.

TABLE 1. Default Occupancy Numbers

	Gross square feet per occupant		Gross square meters per occupant	
	Employees	**Transients**	**Employees**	**Transients**
General office	250	0	23	0
Retail, general	550	130	51	12
Retail or service (e.g., financial, auto)	600	130	56	12
Restaurant	435	95	40	9
Grocery store	550	115	51	11
Medical office	225	330	21	31
R&D or laboratory	400	0	37	0
Warehouse, distribution	2,500	0	232	0
Warehouse, storage	20,000	0	1860	0
Hotel	1,500	700	139	65
Educational, daycare	630	105	59	10
Educational, K–12	1,300	140	121	13
Educational, postsecondary	2,100	150	195	14

Sources:

- ANSI/ASHRAE/IESNA Standard 90.1–2004 (Atlanta, GA, 2004).
- 2001 Uniform Plumbing Code (Los Angeles, CA)
- California Public Utilities Commission, 2004–2005 Database for Energy Efficiency Resources (DEER) Update Study (2008).
- California State University, Capital Planning, Design and Construction Section VI, Standards for Campus Development Programs (Long Beach, CA, 2002).
- City of Boulder Planning Department, Projecting Future Employment—How Much Space per Person (Boulder, 2002).
- Metro, 1999 Employment Density Study (Portland, OR 1999).
- American Hotel and Lodging Association, Lodging Industry Profile Washington, DC, 2008.
- LEED for Core & Shell Core Committee, personal communication (2003 - 2006).
- LEED for Retail Core Committee, personal communication (2007)
- OWP/P, Medical Office Building Project Averages (Chicago, 2008).
- OWP/P, University Master Plan Projects (Chicago, 2008).
- U.S. General Services Administration, Childcare Center Design Guide (Washington, DC, 2003).

APPENDIX 3. RETAIL PROCESS LOAD BASELINES

TABLE 1A. Commercial kitchen appliance prescriptive measures and baseline for energy cost budget (IP units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance Type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline Idle Rate**	**Prescriptive Efficiency**	**Prescriptive Idle Rate**
Broiler, underfired	Gas	Cooking	30%	16,000 Btu/h/ft^2 peak input	35%	12,000 Btu/h/ft^2 peak input
Combination ovens, steam mode (P = pan capacity)	Elec	Cooking	40% steam mode	0.37P+4.5 kW	50% steam mode	0.133P+0.6400 kW
Combination ovens, steam mode	Gas	Cooking	20% steam mode	1,210P+35,810 Btu/h	38% steam mode	200P+6,511 Btu/h
Combination ovens, convection mode	Elec	Cooking	65% convection mode	0.1P+1.5 kW	70% convection mode	0.080P+0.4989 kW
Combination ovens, convection mode	Gas	Cooking	35% convection mode	322P+13,563 Btu/h	44% convection mode	150P+5,425 Btu/h
Convection oven, full-size	Elec	Cooking	65%	2.0 kW	71%	1.6 kW
Convection oven, full-size	Gas	Cooking	30%	18,000 Btu/h	46%	12,000 Btu/h
Convection oven, half-size	Elec	Cooking	65%	1.5 kW	71%	1.0 kW
Conveyor oven, > 25-inch belt	Gas	Cooking	20%	70,000 Btu/h	42%	57,000 Btu/h
Conveyor oven, ≤ 25-inch belt	Gas	Cooking	20%	45,000 Btu/h	42%	29,000 Btu/h
Fryer	Elec	Cooking	75%	1.05 kW	80%	1.0 kW
Fryer	Gas	Cooking	35%	14,000 Btu/h	50%	9,000 Btu/h
Griddle (based on 3 ft model)	Elec	Cooking	60%	400 W/ft^2	70%	320 W/ft^2
Griddle (based on 3 ft model)	Gas	Cooking	30%	3,500 Btu/h/ft^2	38%	2,650 Btu/h/ft^2
Hot food holding cabinets (excluding drawer warmers and heated display) $0 < V < 13$ ft^3 (V = volume)	Elec	Cooking	na	40 W/ft^3	na	21.5V Watts
Hot food holding cabinets (excluding drawer warmers and heated display) $13 \le V < 28$ ft^3	Elec	Cooking	na	40 W/ft^3	na	2.0V + 254 Watts
Hot food holding cabinets (excluding drawer warmers and heated display) 28 ft^3 ≤ V	Elec	Cooking	na	40 W/ft^3	na	3.8V + 203.5 Watts
Large vat fryer	Elec	Cooking	75%	1.35 kW	80%	1.1 kW

TABLE 1A (CONTINUED). Commercial kitchen appliance prescriptive measures and baseline for energy cost budget (IP units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance Type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline Idle Rate**	**Prescriptive Efficiency**	**Prescriptive Idle Rate**
Large vat fryer	Gas	Cooking	35%	20,000 Btu/h	50%	12,000 Btu/h
Rack oven, double	Gas	Cooking	30%	65,000 Btu/h	50%	35,000 Btu/h
Rack oven, single	Gas	Cooking	30%	43,000 Btu/h	50%	29,000 Btu/h
Range	Elec	Cooking	70%		80%	
Range	Gas	Cooking	35%	na	40% and no standing pilots	na
Steam cooker, batch cooking	Elec	Cooking	26%	200 W/pan	50%	135 W/pan
Steam cooker, batch cooking	Gas	Cooking	15%	2,500 Btu/h/pan	38%	2,100 Btu/h/pan
Steam cooker, high production or cook to order	Elec	Cooking	26%	330 W/pan	50%	275 W/pan
Steam cooker, high production or cook to order	Gas	Cooking	15%	5,000 Btu/h/pan	38%	4,300 Btu/h/pan
Toaster	Elec	Cooking	na	1.8 kW average operating energy rate	na	1.2 kW average operating energy rate
Ice machine, IMH (ice-making head, H = harvest ice), H ≥ 450 lb/day	Elec	Ice	6.89 – 0.0011H kWh/100 lb ice	na	$37.72*H^{-0.298}$ kWh/100 lb ice	na
Ice machine, IMH (ice-making head), H < 450 lb/day	Elec	Ice	10.26 – 0.0086H kWh/100 lb ice	na	$37.72*H^{-0.298}$ kWh/100 lb ice	na
Ice machine RCU (remote condensing unit, w/o remote compressor), H < 1,000 lb/day	Elec	Ice	8.85 – 0.0038H kWh/100lb ice	na	$22.95*H^{-0.258}$ + 1.00 kWh/100 lb ice	na
Ice machine RCU (remote condensing unit), 1600 > H ≥ 1000 lb/day	Elec	Ice	5.10 kWh/100 lb ice	na	$22.95*H^{-0.258}$ + 1.00 kWh/100 lb ice	na
Ice machine RCU (remote condensing unit), H ≥ 1600 lb/day	Elec	Ice	5.10 kWh/100 lb ice	na	-0.00011*H + 4.60 kWh/100 lb ice	na
Ice machine SCU (self-contained unit), H < 175 lb/day	Elec	Ice	18.0 – 0.0469H kWh/100 lb ice	na	$48.66*H^{-0.326}$ + 0.08 kWh/100 lb ice	na
Ice machine self-contained unit, H ≥ 175 lb/day	Elec	Ice	9.80 kWh/100 lb ice	na	$48.66*H^{-0.326}$ + 0.08 kWh/100 lb ice	na

TABLE 1A (CONTINUED). Commercial kitchen appliance prescriptive measures and baseline for energy cost budget (IP units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance Type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline Idle Rate**	**Prescriptive Efficiency**	**Prescriptive Idle Rate**
Ice machine, water-cooled ice-making head, H ≥ 1436 lb/day (must be on chilled loop)	Elec	Ice	4.0 kWh/100 lb ice	na	3.68 kWh/100 lb ice	na
Ice machine, water-cooled ice-making head, 500 lb/day < H < 1436 (must be on chilled loop)	Elec	Ice	5.58 – 0.0011H kWh/100 lb ice	na	5.13 – 0.001H kWh/100 lb ice	na
Ice machine, water-cooled ice-making head, H < 500 lb/day (must be on chilled loop)	Elec	Ice	7.80 – 0.0055H kWh/100 lb ice	na	7.02 – 0.0049H kWh/100 lb ice	na
Ice machine water-cooled once-through (open loop)	Elec	Ice	Banned	Banned	Banned	Banned
Ice machine, water-cooled SCU (self-contained unit), H < 200 lb/day (must be on chilled loop)	Elec	Ice	11.4 – 0.0190H kWh/100 lb ice	na	10.6 – 0.177H kWh/100 lb ice	na
Ice machine, water-cooled self-contained unit, H ≥ 200 lb/day (must be on chilled loop)	Elec	Ice	7.6 kWh/100 lb ice	na	7.07 kWh/100 lb ice	na
Chest freezer, solid or glass door	Elec	Refrig	0.45V + 0.943 kWh/day	na	≤ 0.270V + 0.130 kWh/day	na
Chest refrigerator, solid or glass door	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.125V + 0.475 kWh/day	na
Glass-door reach-in freezer 0 < V < 15 ft^3	Elec	Refrig	0.75V + 4.10 kWh/day	na	≤ 0.607V + 0.893 kWh/day	na
Glass-door reach-in freezer 15 ≤ V < 30 ft^3	Elec	Refrig	0.75V + 4.10 kWh/day	na	≤ 0.733V – 1.00 kWh/day	na
Glass-door reach-in freezer, 30 ≤ V < 50 ft^3	Elec	Refrig	0.75V + 4.10 kWh/day	na	≤ 0.250V + 13.50 kWh/day	na
Glass-door reach-in freezer, 50 ≤ V ft^3	Elec	Refrig	0.75V + 4.10 kWh/day	na	≤ 0.450V + 3.50 kWh/day	na
Glass-door reach-in refrigerator, 0 < V < 15 ft^3	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.118V + 1.382 kWh/day	na
Glass-door reach-in refrigerator, 15 ≤ V < 30 ft^3	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.140V + 1.050 kWh/day	na
Glass-door reach-in refrigerator, 30 ≤ V < 50 ft^3	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.088V + 2.625 kWh/day	na

TABLE 1A (CONTINUED). Commercial kitchen appliance prescriptive measures and baseline for energy cost budget (IP units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance Type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline Idle Rate**	**Prescriptive Efficiency**	**Prescriptive Idle Rate**
Glass-door reach-in refrigerator, 50 ≤ V ft^3	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.110V + 1.500 kWh/day	na
Solid-door reach-in freezer, 0 < V < 15 ft^3	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.250V + 1.25 kWh/day	na
Solid-door reach-in freezer, 15 ≤ V < 30 ft^3	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.400V – 1.000 kWh/day	na
Solid-door reach-in freezer, 30 ≤ V < 50 ft^3	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.163V + 6.125 kWh/day	na
Solid-door reach-in freezer, 50 ≤ V ft^3	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.158V + 6.333 kWh/day	na
Solid-door reach-in refrigerator, 0 < V < 15 ft^3	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.089V + 1.411 kWh/day	na
Solid-door reach-in refrigerator, 15 ≤ V < 30 ft^3	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.037V + 2.200 kWh/day	na
Solid-door reach-in refrigerator, 30 ≤ V < 50 ft^3	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.056V + 1.635 kWh/day	na
Solid-door reach-in refrigerator, 50 ≤ V ft^3	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.060V + 1.416 kWh/day	na
Clothes washer	Gas	Sanitation	1.72 MEF	na	2.00 MEF	na
Door-type dish machine, high temp	Elec	Sanitation	na	1.0 kW	na	0.70 kW
Door-type dish machine, low temp	Elec	Sanitation	na	0.6 kW	na	0.6 kW
Multitank rack conveyor dish machine, high temp	Elec	Sanitation	na	2.6 kW	na	2.25 kW
Multitank rack conveyor dish machine, low temp	Elec	Sanitation	na	2.0 kW	na	2.0 kW
Single-tank rack conveyor dish machine, high temp	Elec	Sanitation	na	2.0 kW	na	1.5 kW
Single-tank rack conveyor dish machine, low temp	Elec	Sanitation	na	1.6 kW	na	1.5 kW
Undercounter dish machine, high temp	Elec	Sanitation	na	0.9 kW	na	0.5 kW
Undercounter dish machine, low temp	Elec	Sanitation	na	0.5 kW	na	0.5 kW

The energy efficiency, idle energy rates, and water use requirements, where applicable, are based on the following test methods:

ASTM F1275 Standard Test Method for Performance of Griddles

ASTM F1361 Standard Test Method for Performance of Open Deep Fat Fryers

ASTM F1484 Standard Test Methods for Performance of Steam Cookers

ASTM F1496 Standard Test Method for Performance of Convection Ovens

ASTM F1521 Standard Test Methods for Performance of Range Tops

ASTM F1605 Standard Test Method for Performance of Double-Sided Griddles

ASTM F1639 Standard Test Method for Performance of Combination Ovens

ASTM F1695 Standard Test Method for Performance of Underfired Broilers

ASTM F1696 Standard Test Method for Energy Performance of Single-Rack Hot Water Sanitizing, ASTM Door-Type Commercial Dishwashing Machines

ASTM F1704 Standard Test Method for Capture and Containment Performance of Commercial Kitchen Exhaust Ventilation Systems

ASTM F1817 Standard Test Method for Performance of Conveyor Ovens

ASTM F1920 Standard Test Method for Energy Performance of Rack Conveyor, Hot Water Sanitizing, Commercial Dishwashing Machines

ASTM F2093 Standard Test Method for Performance of Rack Ovens

ASTM F2140 Standard Test Method for Performance of Hot Food Holding Cabinets

ASTM F2144 Standard Test Method for Performance of Large Open Vat Fryers

ASTM F2324 Standard Test Method for Prerinse Spray Valves

ASTM F2380 Standard Test Method for Performance of Conveyor Toasters

ARI 810-2007: Performance Rating of Automatic Commercial Ice Makers

ANSI/ASHRAE Standard 72–2005: Method of Testing Commercial Refrigerators and Freezers with temperature setpoints at 38°F for medium-temp refrigerators, 0°F for low-temp freezers, and -15°F for ice cream freezers

TABLE 1B. Commercial Kitchen Appliance Prescriptive Measures and Baseline for Energy Cost Budget (SI units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline idle Rate**	**Prescriptive Efficiency**	**Prescriptive idle Rate**
Broiler, underfired	Gas	Cooking	30%	50.5 kW/m^2	35%	37.9 kW/m^2
Combination oven, steam mode (P = pan capacity)	Elec	Cooking	40% steam mode	0.37P + 4.5 kW	50% steam mode	0.133P + 0.6400 kW
Combination oven, steam mode	Gas	Cooking	20% steam mode	(1 210P + 35 810)/3 412 kW	38% steam mode	(200P + 6 511)/ 3 412 kW
Combination oven, convection mode	Elec	Cooking	65% convection mode	0.1P + 1.5 kW	70% convection mode	0.080P + 0.4989 kW
Combination oven, convection mode	Gas	Cooking	35% convection mode	(322P + 13 563)/3 412 kW	44% convection mode	(150P + 5 425)/ 3 412 kW
Convection oven, full-size	Elec	Cooking	65%	2.0 kW	71%	1.6 kW
Convection oven, full-size	Gas	Cooking	30%	5.3 kW	46%	3.5 kW
Convection oven, half-size	Elec	Cooking	65%	1.5 kW	71%	1.0 kW
Conveyor oven, > 63.5-cm belt	Gas	Cooking	20%	20.5 kW	42%	16.7 kW
Conveyor oven, < 63.5-cm belt	Gas	Cooking	20%	13.2 kW	42%	8.5 kW
Fryer	Elec	Cooking	75%	1.05 kW	80%	1.0 kW
Fryer	Gas	Cooking	35%	4.1 kW	50%	2.64 kW
Griddle (based on 90-cm model)	Elec	Cooking	60%	4.3 kW/m^2	70%	3.45 kW/m^2

TABLE 1B (CONTINUED). Commercial Kitchen Appliance Prescriptive Measures and Baseline for Energy Cost Budget (SI units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline idle Rate**	**Prescriptive Efficiency**	**Prescriptive idle Rate**
Griddle (based on 90-cm model)	Gas	Cooking	30%	11 kW/m^2	33%	8.35 kW/m^2
Hot food holding cabinets (excluding drawer warmers and heated display) 0 < V < 0.368 m^3 (V = volume)	Elec	Cooking	na	1.4 kW/m^3	na	(21.5*V)/0.0283 kW/m^3
Hot food holding cabinets (excluding drawer warmers and heated display) 0.368 ≤ V < 0.793 m^3	Elec	Cooking	na	1.4 kW/m^3	na	(2.0*V + 254)/0.0283 kW/m^3
Hot food holding cabinets (excluding drawer warmers and heated display) 0.793 m^3 ≤ V	Elec	Cooking	na	1.4 kW/m^3	na	(3.8*V + 203.5)/0.0283 kW/m^3
Large vat fryer	Elec	Cooking	75%	1.35 kW	80%	1.1 kW
Large vat fryer	Gas	Cooking	35%	5.86 kW	50%	3.5 kW
Rack oven, double	Gas	Cooking	30%	19 kW	50%	10.25 kW
Rack oven, single	Gas	Cooking	30%	12.6 kW	50%	8.5 kW
Range	Elec	Cooking	70%	na	80%	na
Range	Gas	Cooking	35%	na	40% and no standing pilots	na
Steam cooker, batch cooking	Elec	Cooking	26%	200 W/pan	50%	135 W/pan
Steam cooker, batch cooking	Gas	Cooking	15%	733 W/pan	38%	615 W/pan
Steam cooker, high production or cook to order	Elec	Cooking	26%	330 W/pan	50%	275 W/pan
Steam cooker, high production or cook to order	Gas	Cooking	15%	1.47 kW/pan	38%	1.26 kW/pan
Toaster	Elec	Cooking	na	1.8 kW average operating energy rate	na	1.2 kW average operating energy rate
Ice machine IMH (ice-making head, H = ice harvest) H ≥ 204 kg/day	Elec	Ice	0.0015 – $5.3464E^{-07}$ kWh/kg ice	na—	≤ $13.52*H^{-0.298}$ kWh/100 kg ice	na
Ice machine IMH (ice making head) ice-making head, H < 204 kg/day	Elec	Ice	0.2262 – $4.18E^{-04}$ kWh/kg ice	na	≤ $13.52*H^{-0.298}$ kWh/100 kg ice	na
Ice machine, RCU (remote condensing unit, w/o remote compressor) H < 454 kg/day	Elec	Ice	0.1951 – $1.85E^{-04}$ kWh/kg ice	na	≤ $111.5835*H^{-0.258}$ + 2.205 kWh/100 kg ice	na

TABLE 1B (CONTINUED). Commercial Kitchen Appliance Prescriptive Measures and Baseline for Energy Cost Budget (SI units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline idle Rate**	**Prescriptive Efficiency**	**Prescriptive idle Rate**
Ice machine RCU (remote condensing unit) 726 > H ≥ 454 kg/day	Elec	Ice	0.1124 kWh/kg ice	na	≤ $111.5835 \cdot H^{-0.258} + 2.205$ kWh/100 kg ice	na
Ice machine RCU (remote condensing unit) H ≥ 726 kg/day	Elec	Ice	0.1124 kWh/kg ice	na	≤ -0.00024H + 4.60 kWh/100 kg ice	na
Ice machine SCU (self contained unit), H < 79 kg/day	Elec	Ice	0.3968 – $2.28E^{-03}$ kWh/kg ice	na	$236.59 \cdot H^{-0.326} + 0.176$ kWh/100 kg ice	na
Ice machine SCU (self-contained unit), H ≥ 79 kg/day	Elec	Ice	0.2161 kWh/kg ice	na	$236.59 \cdot H^{-0.326} + 0.176$ kWh/100 kg ice	na
Ice machine, water-cooled ice-making head, H ≥ 651 kg/day (must be on a chilled loop)	Elec	Ice	0.0882 kWh/kg ice	na	≤ 8.11 kWh/100 kg ice	na
Ice machine, water-cooled ice-making head, 227 ≤ H < 651 kg/day (must be on a chilled loop)	Elec	Ice	0.1230 – $5.35E^{-05}$ kWh/kg ice	na	≤ 11.31 – 0.065H kWh/100 kg ice	na
Ice machine, water-cooled ice-making head, H < 227 kg/day (must be on a chilled loop)	Elec	Ice	0.1720 – $2.67E^{-04}$ kWh/kg ice	na	≤ 15.48 – 0.0238H kWh/100 kg ice	na
Ice machine, water-cooled once-through (open loop)	Elec	Ice	Banned	Banned	Banned	Banned
Ice machine water-cooled SCU (self-contained unit) H < 91 kg/day (must be on a chilled loop)	Elec	Ice	0.2513 – $29.23E^{-04}$ kWh/kg ice	na	≤ 23.37 – 0.086H kWh/100 kg ice	na
Ice machine, water-cooled SCU (self-contained unit) H ≥ 91 kg/day (must be on a chilled loop)	Elec	Ice	0.1676 kWh/kg ice	na	15.57 kWh/100 kg ice	na
Chest freezer, solid or glass door	Elec	Refrig	15.90V + 0.943 kWh/day	na	9.541V + 0.130 kWh/day	na
Chest refrigerator, solid or glass door	Elec	Refrig	3.53V + 2.04 kWh/day	na	≤ 4.417V + 0.475 kWh/day	na
Glass-door reach-in freezer, 0 < V < 0.42 m^3	Elec	Refrig	26.50V + 4.1 kWh/day	na	≤ 21.449V + 0.893 kWh/day	na
Glass-door reach-in freezer, 0.42 ≤ V < 0.85 m^3	Elec	Refrig	26.50V + 4.1 kWh/day	na	≤ 25.901V – 1.00 kWh/day	na
Glass-door reach-in freezer, 0.85 ≤ V < 1.42 m^3	Elec	Refrig	26.50V + 4.1 kWh/day	na	≤ 8.834V + 13.50 kWh/day	na

TABLE 1B (CONTINUED). Commercial Kitchen Appliance Prescriptive Measures and Baseline for Energy Cost Budget (SI units)

	Baseline energy usage for energy modeling path				Levels for prescriptive path	
Appliance type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline idle Rate**	**Prescriptive Efficiency**	**Prescriptive idle Rate**
Glass-door reach-in freezer, $1.42 \le V$ m^3	Elec	Refrig	26.50V + 4.1 kWh/day	na	≤ 15.90V + 3.50 kWh/day	na
Glass-door reach-in refrigerator, $0 < V < 0.42$ m^3	Elec	Refrig	4.24V + 3.34 kWh/day	na	≤ 4.169V + 1.382 kWh/day	na
Glass-door reach-in refrigerator, $0.42 \le V < 0.85$ m^3	Elec	Refrig	4.24V + 3.34 kWh/day	na	≤ 4.947V + 1.050 kWh/day	na
Glass-door reach-in refrigerator, $0.85 \le V < 1.42$ m^3	Elec	Refrig	4.24V + 3.34 kWh/day	na	≤ 3.109V + 2.625 kWh/day	na
Glass-door reach-in refrigerator, $1.42 \le V$ m^3	Elec	Refrig	4.24V + 3.34 kWh/day	na	≤ 3.887V + 1.500 kWh/day	na
Solid-door reach-in freezer, $0 < V < 0.42$ m^3	Elec	Refrig	14.13V + 1.38 kWh/day	na	≤ 8.834V + 1.25 kWh/day	na
Solid-door reach-in freezer, $0.42 < V < 0.85$ m^3	Elec	Refrig	14.13V + 1.38 kWh/day	na	≤ 4.819V – 1.000 kWh/day	na
Solid-door reach-in freezer, $0.85 \le V < 1.42$ m^3	Elec	Refrig	14.13V + 1.38 kWh/day	na	≤ 5.760V + 6.125 kWh/day	na
Solid-door reach-in freezer, $1.42 \le V$ m^3	Elec	Refrig	14.13V + 1.38 kWh/day	na	≤ 5.583V + 6.333 kWh/day	na
Solid-door reach-in refrigerator, $0 < V < 0.42$ m^3	Elec	Refrig	3.53V + 2.04 kWh/day	na	≤ 3.145V + 1.411 kWh/day	na
Solid-door reach-in refrigerator, $0.42 \le V < 0.85$ m^3	Elec	Refrig	3.53V + 2.04 kWh/day	na	≤ 1.307V + 2.200 kWh/day	na
Solid-door reach-in refrigerator, $0.85 \le V < 1.42$ m^3	Elec	Refrig	3.53V + 2.04 kWh/day	na	≤ 1.979V + 1.635 kWh/day	na
Solid-door reach-in refrigerator, $1.42 \le V$ m^3	Elec	Refrig	3.53V + 2.04 kWh/day	na	≤ 2.120V + 1.416 kWh/day	na
Clothes washer	Gas	Sanitation	1.72 MEF		2.00 MEF	
Door-type dish machine, high temp	Elec	Sanitation	na	1.0 kW	na	0.70 kW
Door-type dish machine, low temp	Elec	Sanitation	na	0.6 kW	na	0.6 kW
Multitank rack conveyor dish machine, high temp	Elec	Sanitation	na	2.6 kW	na	2.25 kW
Multitank rack conveyor dish machine, low temp	Elec	Sanitation	na	2.0 kW	na	2.0 kW
Single-tank rack conveyor dish machine, high temp	Elec	Sanitation	na	2.0 kW	na	1.5 kW

TABLE 1B (CONTINUED). Commercial Kitchen Appliance Prescriptive Measures and Baseline for Energy Cost Budget (SI units)						
	Baseline energy usage for energy modeling path				**Levels for prescriptive path**	
Appliance type	**Fuel**	**Function**	**Baseline Efficiency**	**Baseline idle Rate**	**Prescriptive Efficiency**	**Prescriptive idle Rate**
Single-tank rack conveyor dish machine, low temp	Elec	Sanitation	na	1.6 kW	na	1.5 kW
Undercounter dish machine, high temp	Elec	Sanitation	na	0.9 kW	na	0.5 kW
Undercounter dish machine, low temp	Elec	Sanitation	na	0.5 kW	na	0.5 kW

The energy efficiency, idle energy rates, and water use requirements, where applicable, are based on the following test methods:

ASTM F1275 Standard Test Method for Performance of Griddles

ASTM F1361 Standard Test Method for Performance of Open Deep Fat Fryers

ASTM F1484 Standard Test Methods for Performance of Steam Cookers

ASTM F1496 Standard Test Method for Performance of Convection Ovens

ASTM F1521 Standard Test Methods for Performance of Range Tops

ASTM F1605 Standard Test Method for Performance of Double-Sided Griddles

ASTM F1639 Standard Test Method for Performance of Combination Ovens

ASTM F1695 Standard Test Method for Performance of Underfired Broilers

ASTM F1696 Standard Test Method for Energy Performance of Single-Rack Hot Water Sanitizing, ASTM Door-Type Commercial Dishwashing Machines

ASTM F1704 Standard Test Method for Capture and Containment Performance of Commercial Kitchen Exhaust Ventilation Systems

ASTM F1817 Standard Test Method for Performance of Conveyor Ovens

ASTM F1920 Standard Test Method for Energy Performance of Rack Conveyor, Hot Water Sanitizing, Commercial Dishwashing Machines

ASTM F2093 Standard Test Method for Performance of Rack Ovens

ASTM F2140 Standard Test Method for Performance of Hot Food Holding Cabinets

ASTM F2144 Standard Test Method for Performance of Large Open Vat Fryers

ASTM F2324 Standard Test Method for Prerinse Spray Valves

ASTM F2380 Standard Test Method for Performance of Conveyor Toasters

ARI 810-2007: Performance Rating of Automatic Commercial Ice Makers

ANSI/ASHRAE Standard 72–2005: Method of Testing Commercial Refrigerators and Freezers with temperature setpoints at 3°C for mediumtemp refrigerators, -18°C for low-temp freezers, and -26°C for ice cream freezers.

TABLE 2. Supermarket refrigeration prescriptive measures and baseline for energy cost budget			
Item	**Attribute**	**Prescriptive Measure**	**Baseline for Energy Modeling Path**
Commercial Refrigerator and Freezers	Energy Use Limits	ASHRAE 90.1-2010 Addendum g. Table 6.8.1L	ASHRAE 90.1-2010 Addendum g. Table 6.8.1L
Commercial Refrigeration Equipment	Energy Use Limits	ASHRAE 90.1-2010 Addendum g. Table 6.8.1M	ASHRAE 90.1-2010 Addendum g. Table 6.8.1M

TABLE 3. Walk-in coolers and freezers prescriptive measures and baseline for energy cost budget			
Item	**Attribute**	**Prescriptive Measure**	**Baseline for Energy Modeling Path**
Envelope	Freezer insulation	R-46	R-36
	Cooler insulation	R-36	R-20
	Automatic closer doors	Yes	No
	High-efficiency low- or no-heat reach-in doors	40W/ft (130W/m) of door frame (low temperature), 17W/ft (55W/m) of door frame (medium temperature)	40W/ft (130W/m) of door frame (low temperature), 17W/ft (55W/m) of door frame (medium temperature)

Evaporator	Evaporator fan motor and control	Shaded pole and split phase motors prohibited; use PSC or EMC motors	Constant-speed fan
	Hot gas defrost	No electric defrosting	Electric defrosting
Condenser	Air-cooled condenser fan motor and control	Shaded pole and split phase motors prohibited; use PSC or EMC motors; add condenser fan controllers	Cycling one-speed fan
	Air-cooled condenser design approach	Floating head pressure controls or ambient subcooling	10°F (-12°C) to 15°F (-9°C) dependent on suction temperature
Lighting	Lighting power density (W/sq.ft.)	0.6 W/sq.ft. (6.5 W/sq. meter)	0.6 W/sq.ft. (6.5 W/sq. meter)
Commercial Refrigerator and Freezers	Energy Use Limits	na	Use an Exceptional Calculation Method if attempting to take savings
Commercial Refrigerator and Freezers	Energy Use Limits	na	Use an Exceptional Calculation Method if attempting to take savings

TABLE 4. Commercial kitchen ventilation prescriptive measures and baseline for energy cost budget

Strategies	Prescriptive Measure	Baseline
Kitchen hood control	ASHRAE 90.1-2010 Section 6.5.7.1, except that Section 6.5.7.1.3 and Section 6.5.7.1.4 shall apply if the total kitchen exhaust airflow rate exceeds 2,000 cfm (960 L/s) (as opposed to 5,000 cfm (2,400 L/s) noted in the ASHRAE 90.1-2010 requirements)	ASHRAE 90.1-2010 Section 6.5.7.1 and Section G3.1.1 Exception (d) where applicable