REFERENCE GUIDE FOR **BUILDING OPERATIONS AND MAINTENANCE**

Updated August 2019

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U.S. Green Building Council
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Suite 500
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John Boecker	7group
Penny Bonda	Ecoimpact Consulting
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Joel Todd	Joel Ann Todd
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Heather Rosenberg	The Cadmus Group
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Keith Winn	Catalyst Partners
Bill Worthen	Urban Fabrik
Max Zahniser	Praxis | Building Solutions

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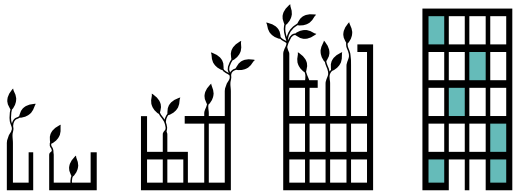


THE CASE FOR GREEN BUILDING OPERATIONS AND MAINTENANCE

Green buildings are an integral part of the solution to the environmental challenges facing the planet.

Today we use the equivalent of 1.5 Earths to meet the resource needs of everyday life and absorb the resulting wastes. This measure of our planet's carrying capacity means that it takes Earth 18 months to regenerate what is used in only 12 months. If current trends continue, estimates suggest, by the year 2030 we will need the equivalent of two planets.[1] Turning resources into waste faster than they can be regenerated puts the planet into ecological overshoot, a clearly unsustainable condition that we all must address.

The forces driving this situation are numerous. Human population has increased exponentially in the past 60 years, from about 2.5 billion in 1950 to more than 7 billion today. Our linear use of resources, treating outputs as waste, is responsible for the toxins that are accumulating in the atmosphere, in water, and on the ground. This pattern of extraction, use, and disposal has hastened depletion of finite supplies of nonrenewable energy, water, and materials and is accelerating the pace of our greatest problem—climate change. Buildings account for a significant portion of greenhouse gas emissions; in the U.S., buildings are associated with 38% of all emissions of carbon dioxide[2]. Globally, the figure is nearly one-third.[3] The problem is anticipated to worsen as developing countries attain higher standards of living. The problem is anticipated to worsen as developing countries achieve higher standards of living.

These forces are bringing us to a tipping point, a threshold beyond which Earth cannot rebalance itself without major disruption to the systems that humans and other species rely on for survival.

The impetus behind development of the Leadership in Energy and Environmental Design (LEED) rating systems was recognition of those problems, coupled with awareness that the building industry—from construction and renovation to operations and maintenance—already had the expertise, tools, and technology to transform daily operations and make significant advances toward a sustainable planet. LEED projects throughout the world have already demonstrated the benefits of taking a green operations and maintenance approach that reduces the environmental harms of existing buildings and restores the balance of natural systems. The opportunity that existing commercial buildings represent is enormous: as world population continues to increase, people have begun to use old buildings in new ways. About 40 percent of the energy consumed in the U.S. and other developed nations is attributable to building operations, and 80 million square feet of the operating building stock is commercial space[4].

1. *Global Footprint Network, footprintnetwork.org/en/index.php/gfn/page/world_footprint/, accessed 9/11/2012*
2. *Energy Information Administration (2008). Assumptions to the Annual Energy Outlook*
3. *unep.org/sbci/pdfs/SBCI-BCCSummary.pdf*
4. *iea.org/aboutus/faqs/energyefficiency/.*

ABOUT LEED

Developed by the U.S. Green Building Council, LEED is a framework for identifying, implementing, and measuring green building and neighborhood design, construction, operations, and maintenance. LEED is a voluntary, market-driven, consensus-based tool that serves as a guideline and assessment mechanism for the design, construction, and operation of high-performance green buildings and neighborhoods. LEED rating systems currently address commercial, institutional, and residential building types as well as neighborhood development.

LEED seeks to optimize the use of natural resources, promote regenerative and restorative strategies, maximize the positive and minimize the negative environmental and human health consequences of the building industry, and provide high-quality indoor environments for building occupants. LEED emphasizes integrative design, integration of existing technology, and state-of-the-art strategies to advance expertise in green building and transform professional practice. The technical basis for LEED strikes a balance between requiring today's best practices and encouraging leadership strategies. LEED sets a challenging yet achievable set of benchmarks for interior spaces, entire structures, and whole neighborhoods.

LEED for New Construction and Major Renovations was developed in 1998 for the commercial building industry and has since been updated multiple times. Over the years, a variety of other rating systems have been developed to meet the needs of different market sectors.

Since its launch, LEED has evolved to address new markets and building types, advances in practice and technology, and greater understanding of the environmental and human health effects of the built environment. These ongoing improvements, developed by USGBC member-based volunteer committees, subcommittees, and working groups in conjunction with USGBC staff, have been reviewed by the LEED Steering Committee and the USGBC Board of Directors before being submitted to USGBC members for a vote. The process is based on principles of transparency, openness, and inclusiveness.

LEED'S GOALS

The LEED rating systems aim to promote a transformation of the construction industry through strategies designed to achieve seven goals:

- To reverse contribution to global **climate change**
- To enhance individual **human health** and well-being
- To protect and restore **water resources**
- To protect, enhance, and restore **biodiversity** and ecosystem services
- To promote sustainable and regenerative **material resources** cycles
- To build a **greener economy**
- To enhance social equity, environmental justice, **community** health, and quality of life

These goals are the basis for LEED's prerequisites and credits. In the LEED for Building Operations and Maintenance rating system, the major prerequisites and credits are categorized as Location and Transportation (LT), Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials and Resources (MR), and Indoor Environmental Quality (EQ).

The goals also drive the weighting of points toward certification. Each credit in the rating system is allocated points based on the relative importance of its contribution to the goals. The result is a weighted average: credits that most directly address the most important goals are given the greatest weight. Project teams that meet the prerequisites and earn enough credits to achieve certification have demonstrated performance that spans the goals in an integrated way. Certification is awarded at four levels (Certified, Silver, Gold, Platinum) to incentivize higher achievement and, in turn, faster progress toward the goals.

BENEFITS OF USING LEED

LEED is designed to address environmental challenges while responding to the needs of a competitive market. Certification demonstrates leadership, innovation, environmental stewardship, and social responsibility. LEED gives building owners and operators the tools they need to immediately improve both building performance and the bottom line while providing healthful indoor spaces for a building's occupants.

LEED-certified buildings are designed to deliver the following benefits:

- Lower operating costs and increased asset value
- Reduced waste sent to landfills
- Energy and water conservation
- More healthful and productive environments for occupants
- Reductions in greenhouse gas emissions
- Qualification for tax rebates, zoning allowances, and other incentives in many cities

By participating in LEED, owners, operators, designers, and builders make a meaningful contribution to the green building industry. By documenting and tracking buildings' resource use, they contribute to a growing body of knowledge that will advance research in this rapidly evolving field. This will allow future projects to build on the successes of today's designs and bring innovations to the market.

LEED CERTIFICATION PROCESS

The process begins when the owner selects the rating system and registers the project (see *Rating System Selection Guidance*). The project team then meets the requirements for all prerequisites and for the credits the team has chosen to pursue. After documentation has been submitted for certification, a project goes through preliminary and final reviews. The preliminary review provides technical advice on credits that require additional work for achievement, and the final review contains the project's final score and certification level. The decision can be appealed if a team believes additional consideration is warranted.

LEED has four levels of certification, depending on the point thresholds achieved:

- Certified, 40–49 points
- Silver, 50–59 points
- Gold, 60–79 points
- Platinum, 80 points and above

There are also two alternative certification processes for owners with multiple buildings pursuing LEED certification, (1) LEED volume certification and (2) LEED campus certification. This reference guide covers credit-specific guidance for LEED campus certification. In some cases the LEED campus certification is used to achieve one single certification for many buildings (group certification project) and in others it used to achieve pre-approval for credits to be utilized by a number of certifications (campus credits).

See www.gbci.org for more information about the review processes and eligibility requirements.

INITIAL CERTIFICATION AND RECERTIFICATION

The LEED for Building Operations and Maintenance rating system can be applied both to buildings seeking LEED certification for the first time and to projects previously certified under any version of the LEED Design and Construction rating systems. It is the only LEED rating system that requires projects to recertify.

Initial certification is any first-time application for LEED for Building Operations and Maintenance certification. Recertification is the subsequent application(s) for certification after a project has received an initial certification under any version of LEED for Building Operations and Maintenance. To the extent possible, projects will be held to the requirements of the most current rating system version available on the date the project registers for recertification.

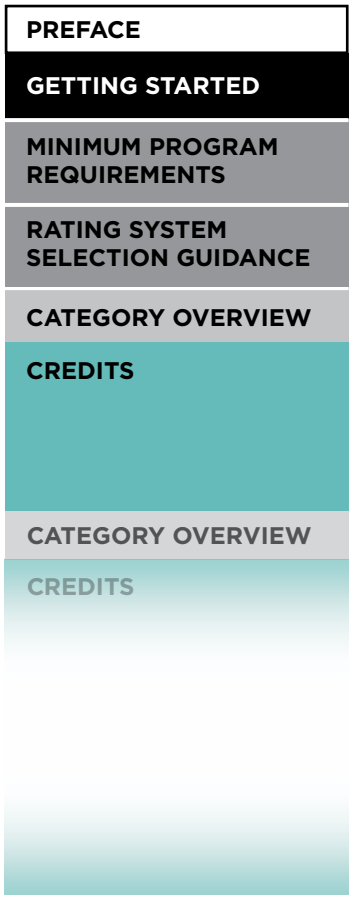
REFERENCE GUIDE OVERVIEW

GUIDE STRUCTURE

GETTING STARTED
provides a recommended process for achieving certification and addresses issues that cut across the entire rating system.

CATEGORY OVERVIEWS
emphasize sustainability topics, market factors, and credit relationships that are specific to a single credit category and information that is applicable to multiple credits within that category.

CREDITS
contain content that is specific to the achievement of that credit.



CREDIT STRUCTURE

Each credit category begins with an overview that discusses sustainability and market factors specific to the category. For each prerequisite and credit, readers will then find the following sections:

INTENT & REQUIREMENTS
outlines the rating system requirements for achieving the prerequisite or credit. They were approved through the rating system development process and can also be found on the USGBC website.

BEHIND THE INTENT
connects credit achievement with larger sustainability issues and provides information on how the credit requirements meet the intent stated in the rating system.

STEP-BY-STEP GUIDANCE
suggests the implementation and documentation steps that can be used by most projects, as well as generally applicable tips and examples.

FURTHER EXPLANATION
provides guidance for lengthy calculations or for special project situations, such as tips for nonstandard project types or different credit approaches. It includes a *Campus* section and, sometimes, an *International Tips* section.

REQUIRED DOCUMENTATION
lists the items that must be submitted for certification review.

RELATED CREDIT TIPS
identifies other credits that may affect a project team's decisions and strategies for the credit in question; the relationships between credits may imply synergies or trade-offs.

CHANGES FROM LEED 2009
is a quick reference of changes from the previous version of LEED.

REFERENCED STANDARDS
lists the technical standards related to the credit and offers weblinks to find them.

EXEMPLARY PERFORMANCE
identifies the threshold that must be met to earn an exemplary performance point, if available.

DEFINITIONS
gives the meaning of terms used in the credit.

ICONS THAT MAY APPEAR WITHIN EACH CREDIT REFER THE USER TO FOLLOWING SECTIONS:

Getting Started (beginning of book)

Further Explanation (within same credit)

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

LOCATION AND TRANSPORTATION (LT)

SUSTAINABLE SITES (SS)

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.

PROJECTS USING CAMPUS CERTIFICATION

The Campus section is for projects using LEED campus certification.

The guidance under Group Approach must be followed by group certification projects. Group certification projects receive a single certification for all buildings included in the group, but are still required to demonstrate credit compliance at the building level for some credits. If the guidance under Group Approach states "All buildings in the group may be documented as one.", then credit compliance can be demonstrated for the group as a whole, for example, by pooling resources or purchasing. However, if the guidance under Group Approach states "Submit separate documentation for each building.", then credit compliance must be demonstrated for each building individually, for example, by performing one calculation per building.

The guidance under Campus Approach must be followed by projects pursuing the credit as a campus credit. Note that an additional registration and review under a master site is required, which results in a pre-approval of the credit for all projects registered under the master site. Only certain credits are available and appropriate to be pursued at the campus level. The guidance under Campus Approach will indicate whether the credit is "Eligible." or "Ineligible.". If the credit is ineligible, each project may still earn the credit but it must be pursued during the regular individual or group project review process rather than through the master site.

PROJECTS OUTSIDE THE US

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.

AN INTEGRATIVE APPROACH TO OPERATIONS AND MANAGEMENT

To meet human needs without compromising the bottom line, green building operations require dedication and buy-in from all levels of building and tenant management. The path to sustainable operations requires collaboration, integrative thinking, and a strong team whose members have clearly defined roles and responsibilities.

Successful operations practice engages all team members and emphasizes each person's responsibility for continuing sustainable strategies during transitions and change-over periods. It requires collaborative decision making and information sharing by everyone involved, including staff who oversee waste, chemical applications, or product purchases.

As the team is drafting and implementing a new building policy, for example, an approach that draws on the expertise of all project stakeholders—owner, occupant, engineers, facilities managers, financial managers, contractor—may reveal innovative solutions.

PROJECT GOALS

An integrated team can develop project goals that lay a strong foundation for achievement. The project goals should reflect organizational values and operational realities as well as sustainability targets. Include building stakeholders who understand current facilities practices, such as the owner, building management staff, occupants, and vendors. A diverse team ensures that all operational elements will be considered and the program will be supported by the entire team.

Take a hard look at traditional practices and management and consider the flow of materials, water, and energy through the building and site. For existing buildings, this requires a site study that considers on-site resources and the building's location, orientation, massing, and occupant use patterns. The goal is to identify ways to reduce the loads and environmental harms of each system without increasing those of any others.

Identify existing policies, practices, equipment, contracts, and budgets to set a baseline for improvement. After collecting baseline information, list the areas that may require significant change, moderate change, and low- or no-cost change in operating practices. Identify any organizational issues or pressures that may influence the project goals. Prioritize strategies that are aligned with environmental and organizational values and operational realities.

Environmental Goals

The selection of LEED credits often depends on the project's environmental context, particularly current energy use and site conditions.

- **Energy signature.** To understand how the building behaves in response to the outdoor environment, consider its energy signature—an analysis of measured energy use in relation to seasonal fluctuations in temperature. An energy signature highlights seasonal norms that may prompt operating change and alerts the team to operating inefficiencies. In addition, an energy signature provides insight into whether current systems are meeting the building's heating and cooling needs.
- **Energy benchmarks.** Compare the building's energy use against recognized standards. By benchmarking early, the project team will have time to look at monthly trends in energy use intensity and ENERGY STAR score (where appropriate). Staff will become familiar with recording and reading consumption data and be ready to set efficiency goals.
- **Site analysis.** A detailed site analysis identifies specific conditions—topography, wind patterns, solar availability and shading, water bodies, view corridors—that may guide decisions on rainwater runoff mitigation, landscape water reduction strategies, onsite renewable energy, and other capital investments. Opportunities for improving and preserving the ecological integrity of the site may become clear.

Organizational Goals

Aligning project goals with the owner's and tenants' organizational values allows teams to select green operations strategies that make a strong business case. Examine the following.

- **Corporate social responsibility report.** The owner's or tenant's organizational goals and priorities, articulated in this report, may include aspirations that align with LEED credits.
- **Organizational annual metrics.** Many organizations have requirements for reporting annual statistics on greenhouse gas emissions and waste recycling from their operations. Selecting credits whose achievement improves these metrics will reinforce current efforts.
- **Human resources policies.** These policies and programs may set goals for health initiatives, employee retention, commute trip reduction, or workplace satisfaction, each of which suggests a focus on credits that target employees' well-being.
- **Shareholders' or stakeholders' concerns.** Stakeholders in the organization and project development team may have strongly held ideas about specific sustainability issues. Involving them early in the process ensures that their interests are well represented.

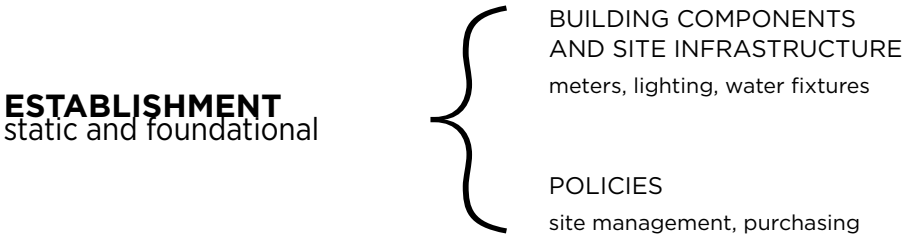
THE CREDIT STRUCTURE OF LEED FOR BUILDING OPERATIONS AND MAINTENANCE

For existing buildings pursuing LEED certification, the establishment period is the time when building infrastructure is assessed, policies are drafted, and programs and processes are put in place to enable ongoing performance measurement. The performance period is the continuous implementation of the strategies set during the establishment period.

Each prerequisite and credit lists the establishment and performance requirements separately. The establishment requirements set projects up for compliance with the performance requirements.

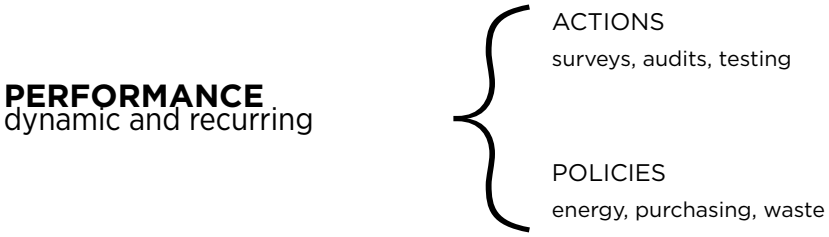
Establishment requirements fall into two categories of credits, those based on building components and site infrastructure and those based on policies and plans:

- Building components and site infrastructure are the characteristics and systems of the building.
- Policies and plans are statements that set goals and outline the implementation of operational management strategies.



Performance requirements also typically fall into two categories of credits, those that require discrete actions and those that require ongoing tracking and measurement over time:

- Actions are regularly repeated to inform continued performance and to identify opportunities for improvement.
- Ongoing tracking occurs continually, verifying ongoing high performance and upkeep of building systems.



UNDERSTAND PERFORMANCE PERIODS

LEED for Building Operations and Maintenance certification is based largely on successful outcomes during the performance period, when sustainable operations are being measured. Many prerequisites and credits require that operating data and other documentation be submitted for the performance period. Since the project's certification level is based on these outcomes, the performance period may not have any gaps, defined as any period of time longer than one full week.

The initial performance period is the most recent period of operations preceding the certification application. It must be at least three months but no more than 24 months, except as noted in the credit requirements.

All performance periods must overlap and conclude within 30 days of each other. In the example (Table 1), each performance period is at least three months, and the termination dates range from April 1 through April 26.

TABLE 1. Example performance periods, by credit

Credit	Start	End*	Duration**
WE Credit Outdoor Water Use	February 22, 2014	April 20, 2015	14 months
SS Credit Rainwater Management	April 6, 2014	April 22, 2015	12.5 months
EA Prerequisite Minimum Energy Performance	April 1, 2014	April 1, 2015	12 months
SS Credit Site Management	August 25, 2014	April 25, 2015	8 months
WE Prerequisite Indoor Water Use	January 12, 2015	April 26, 2015	3.5 months

* All performance periods must end with the same 30-day interval.

** Minimum duration = 3 months; maximum duration = 24 months

To ensure that certification is awarded based on current building performance data, LEED for Building Operations and Maintenance certification applications must be submitted for review within 60 calendar days of the end of the performance periods. The 60-day period starts the day after the last day of the latest performance period.

In the example given above (Table 1), the last day of a performance period is April 26; the project team must submit its application in 60 days, counting from April 27.

RECERTIFICATION

Projects must recertify within five years of the previous certification and are eligible as often as every 12 months.

The recertification performance period extends from the date of the previous certification to the date of the recertification application. If projects pursue new credits in the recertification application, they may use the initial certification performance period rules (see *Understand Performance Periods*, above), unless otherwise noted in the credit requirements.

Since buildings do not stop operations while waiting for certification, it is recommended that project teams continue to track building performance during the certification review process.

Projects pursuing recertification are required to submit only performance documentation for review; they are not required to submit establishment documentation unless there have been major changes (e.g., major renovations, major addition, management turnover) that prompt review.

LEED WORK PLAN

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

STEP 1. 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 2. 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 3. DEFINE LEED PROJECT SCOPE

Review the project's program and initial findings from the goal-setting workshop to identify the project scope. Considerations include multiple buildings and management variations.

Next, map the LEED project boundary to comply with the minimum program requirements.

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 owner is planning multiple similar projects in different locations, Volume may be a useful program to streamline certification. If the project includes multiple buildings in a single location, Campus may be appropriate.

STEP 4. 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.

A gap analysis may identify the feasibility of certain strategies and indicate whether the team should conduct energy audits, commission building systems, or start organizing utility data in preparation for the performance period. Using this information, the team can identify priority and supporting credits.

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 the performance period.

STEP 5. ASSIGN ROLES AND RESPONSIBILITIES

Select one team member to take primary responsibility for leading the group through the LEED application and documentation process.

Cross-disciplinary team ownership of credit compliance can help foster integrated implementation 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; this includes assigning responsibility for crucial tasks like water meter reading, purchases tracking, and vendor management. Clarify responsibilities for ensuring that policy and infrastructure upgrade decisions are fully implemented and documented, and that performance outcomes align with operational intent and goals.

Establish regular meeting dates and develop clear communication channels to streamline the process and resolve issues quickly. Double-check that all assignments for surveys, tracking, and audits are clear and that team members understand their roles.

STEP 6. DETERMINE PERFORMANCE PERIOD

Determining a performance period schedule is necessary for compliance with most credits. All performance periods must end within 30 days of each other and (for a newly attempted credit) last at least three months but no more than 24 months (see *Understand Performance Periods*, above).

STEP 7. DEVELOP CONSISTENT DOCUMENTATION

Consistent documentation is critical to LEED certification success. Designate one person as the single point of contact for all LEED documentation. Data accumulated throughout the performance period, such as purchasing activities, should be uploaded regularly to allow the team to track ongoing progress. The *Maintaining Consistency in the Application* section, below, and the credit category overviews discuss common consistency issues that will affect achievement of multiple credits.

STEP 8. 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 presentation of the project and avoid 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 must be consistent, e.g. site area.

MAINTAINING CONSISTENCY IN THE APPLICATION

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

EFFECTIVE POLICY DEVELOPMENT

The following components must be included in policies developed for compliance with LEED prerequisites and credits.

Physical and programmatic scope. Describe the physical and programmatic scope of the policy. If any spaces within the building or site are excluded, describe the exemption and explain the reason.

Duration of applicability. Identify the time period to which the policy applies. For example, "This policy shall take effect on XX/XX/XXXX and shall continue indefinitely or until amended and/or replaced by a subsequent sustainable purchasing policy."

Responsible parties. By full name and title or position, name the person who will implement the policy. If a vendor is responsible for implementing parts of the plan, name both the vendor and the building manager to whom the vendor reports. Including contact information makes it easy for anybody who references the policy to reach the responsible party. If there are multiple responsible parties, consider identifying clearly which components of the policy each oversees.

Sustainability goals and objectives. Identify the sustainability goals of the policy. Goals must be measurable and are typically numerical. For example, "50% of waste (measured by weight) will be diverted from the landfill" or "75% of ice melt purchased will meet sustainability requirements." Although measurable goals must be set, documentation to demonstrate actual achievement of the set goals is not required for these policies.

Performance evaluation metrics. Explain how actual outcomes and sustainability performance for each element of the policy will be measured and tracked over time. For example, "the percentage of waste diverted will be measured by weight" or "the percentage of cleaning purchases that meet sustainability requirements will be measured by cost."

Procedures and strategies for implementation. Outline the procedures, strategies, and best management practices to be used to achieve the goals. For projects with multiple tenants, describe how building managers will provide education and guidance to encourage tenants to comply. To help with implementation, list contacts, websites, past experiences, and other resources.

Quality assurance process. Describe how the responsible party will verify that the policy is being implemented, that the metrics reflect the actual outcomes, and that performance persists over time. This may include periodic checks to make sure the policy is consistently implemented and that the set goals are being achieved.

OCCUPANCY

Many kinds of people use a typical LEED building, and the mix varies by project type. Occupants are sometimes referred to in a general sense; for example, "Provide places of respite that are accessible to patients and visitors." 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.

FTE employees = Full-time employees + (Σ 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.

FTE employees = (Σ 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.

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

TABLE 2. Occupancy types for calculations, by project type variation

Prerequisite, credit	Regular building occupants	Average daily visitors	Peak visitors	Other	Notes
LT Credit Alternative Transportation					
Existing Buildings, Data Centers, Warehouses and Distribution Centers, Hospitality, Schools, Retail	**X**	**X**	**X**		Counting hotel guests is not required. Only students of driving age must be counted.
EQ Credit Occupant Comfort Survey					
Existing Buildings, Data Centers, Warehouses and Distribution Centers, Hospitality, Schools, Retail	**X**				
WE Prerequisite and Credit Indoor Water Use					
Existing Buildings, Data Centers, Warehouses and Distribution Centers, Hospitality, Schools, Retail	X	X			Retail customers are considered separately and not included in average daily visitors.

CONSIDERING OCCUPANT IMPACT IN AN EXISTING BUILDING

Occupants' interaction with a building may enhance or compromise the sustainability and efficiency goals of the operations team and owner. For example, if the occupants have complete control over temperature and lighting, energy consumption may rise, but too little control may increase complaints to facilities staff. Similarly, an open-office layout that allows views to the outdoors could compromise acoustics and productivity and also affect heating and cooling. Energy efficiency and indoor environmental quality goals entail many such trade-offs.

Making decisions that account for occupant preferences is likely to increase their satisfaction with their working environment and encourage them to take interest in achieving the long term sustainability goals of the organization.

Surveying occupants during the establishment period will shed light on their preferences and needs and help inform project goals at the outset. A subsequent survey will indicate how well the new policies and systems are working.

TENANT SPACE EXCLUSION ALLOWANCE

Projects with leased spaces may face particular challenges in earning LEED for Building Operations and Maintenance credits. Whereas the prerequisites address the base building systems or are limited to areas under management control, many credits require commitment and cooperation from tenants. Project teams should review the lease terms and management situation and either obtain commitments from tenants or pursue credits that do not require tenants' participation. Projects that have a few large tenants may be able to satisfy the requirements more easily than buildings with many small tenant spaces.

Projects may exclude up to 10% of the total gross building floor area from the LEED project boundary, which will apply consistently throughout the submission except in EQ Environmental Tobacco Smoke, where the entire building must be considered. Projects may take an additional 10% exemption on a credit-by-credit basis if it is not possible to gather the necessary tenant data for these credits, or the applicant does not have control over the required element (this additional 10% may not be applied to the EA Prerequisite Minimum Energy Performance). The specific spaces excluded as part of the 10% can vary by credit. Project teams must clearly note which spaces have been excluded in which credit when preparing documentation for certification.

MINIMUM OCCUPANCY

EA Prerequisite Minimum Energy Performance includes a minimum occupancy requirement. No other credits specify a minimum occupancy threshold.

VARIABLE OCCUPANCY

When occupancy rates vary over the performance period, that variation should be reflected in credit calculations via a time-weighted average.

Generally, for partially occupied buildings, project teams document the performance of the entire building as if it were fully occupied. Because completely vacant or unused space has no activity and may lack the furnishings, fixtures, and equipment intended for regular operations, however, partial occupancy changes the way the performance is documented for the following credits.

WE Prerequisite Indoor Water Use and WE Credit Indoor Water Use

To determine the annual usage of each plumbing fixture type, use the following rules:

- For floors or separate tenant spaces that are partially occupied during part of the performance period, use the regular procedures to document prerequisite achievement. Extrapolate partial-year data to derive annual values unless circumstances justify an adjustment.
- For floors or separate tenant spaces that are completely vacant or unused throughout the entire performance period, base usage on the estimated occupancy count. Allocate occupants to the building's fixture types in a reasonable way. Create usage groups in the indoor water use reduction calculator to account for the vacant areas.

These rules apply to both base building or core fixtures and tenant space fixtures. If fixture upgrades are required to achieve compliance, it is recommended that project teams first focus on base building or core fixtures.

EQ Prerequisite Minimum Indoor Air Quality Performance

For mechanically ventilated spaces that are partially occupied during part the performance period or completely vacant or unused throughout the entire performance period, use the regular procedures, with the following exceptions.

- Determine the minimum amount of outdoor air that must be supplied at full occupancy. Perform calculations using the estimated occupancy count if needed.
- Measure the outdoor airflow rates to determine whether the systems can deliver sufficient ventilation under assumed normal full-occupancy conditions.
- For actual operation, consider reducing the amount of outdoor air supplied to the partially occupied, vacant, or unused space.

For naturally ventilated spaces, use the normal procedures for this prerequisite.

EQ Credit Enhanced Indoor Air Quality Strategies and EQ Credit Thermal Comfort
For spaces that are completely vacant or unused throughout the entire performance period, the team has two choices:

- Install the appropriate particle filters or air-cleaning devices or monitoring devices, or
- Exclude the vacant or unused space from the credit requirements.

If the space becomes occupied, however, it will need to be included to achieve the credit in future LEED certifications.

Vacant or unused spaces do not need to be monitored or tested during the performance period.

EQ Credit Interior Lighting and EQ Credit Daylight and Views
For spaces that are completely vacant or unused throughout the entire performance period but have furnishings, fixtures, and equipment intended for regular operations, use the regular procedures.

For spaces that are completely vacant or unused throughout the entire performance period, exclude this area from credit calculations and measurements. If a space becomes occupied, however, it will need to be included to achieve the credit in future LEED certifications.

EQ Credit Occupant Comfort Survey
The Occupant Comfort Survey credit requires that survey responses be collected from a representative sample of building occupants, making up at least 30% of the total occupants. For partially occupied buildings, use actual occupancy (or a time-weighted average if occupancy varies through the performance period) to determine how many occupants must be surveyed.

PROJECTS WITH SEVERAL PHYSICALLY DISTINCT STRUCTURES

Primary and secondary school projects, hospitals (general medical and surgical), hotels, resorts, and resort properties, as defined for ENERGY STAR building rating purposes, are eligible to include more than one physically distinct structure in a single LEED project certification application without having to use the Campus Program, subject to the following conditions.

- The buildings to be certified must be a part of the same identity. For example, the buildings are all part of the same elementary school, not a mix of elementary school and high school buildings.
- The project must be analyzed as a whole (i.e., in aggregate) for all minimum program requirements (MPRs), prerequisites, and credits in the LEED rating system.
- All the land area and all building floor areas within the LEED project boundary must be included in every prerequisite and credit submitted for certification.
- There is no specific limit on the number of structures, but the aggregate gross floor area included in a single project must not exceed 1 million square feet (92 905 square meters).

Any single structure that is larger than 25,000 square feet (2 320 square meters) must be registered as a separate project or treated as a separate building in a group certification approach.

QUICK REFERENCE

TABLE 3. Credit Attributes

Category	Prerequisite/ Credit	Credit Name	Eligibility		Exemplary Performance
			Campus Approach	Group Approach	
LT Location and Transportation					
LT	C	Alternative Transportation	-	G	yes
SS Sustainable Sites					
SS	P	Site Management Policy	C	G	no
SS	C	Site Development--Protect or Restore Habitat	Opt 1 - YES Opt 2 - no	G	yes
SS	C	Rainwater Management	C	G	yes
SS	C	Heat Island Reduction	Opt 1 - YES Opt 2 - no Opt 3 – no Opt 4 - no	G	yes
SS	C	Light Pollution Reduction	C	G	no
SS	C	Site Management	no	G	no
SS	C	Site Improvement Plan	no	G	no
SS	C	Joint Use of Facilities	-	-	no
WE Water Efficiency					
WE	P	Indoor Water Use Reduction	-	-	no
WE	P	Building-Level Water Metering	-	-	no
WE	C	Outdoor Water Use Reduction	Opt 1 - YES Opt 2 - YES Opt 3 - no	G	no
WE	C	Indoor Water Use Reduction	-	G	yes
WE	C	Cooling Tower Water Use	C	G	no
WE	C	Water Metering	-	G	no
EA Energy and Atmosphere					
EA	P	Energy Efficiency Best Management Practices	-	G	no
EA	P	Minimum Energy Performance	-		no
EA	P	Building Level Energy Metering	-	-	no
EA	P	Fundamental Refrigerant Management	-	-	no
EA	C	Existing Building Commissioning--Analysis	-	G	no
EA	C	Existing Building Commissioning—Implementation	-	G	no
EA	C	Ongoing Commissioning	-	G	no
EA	C	Optimize Energy Performance	-	G	yes

Points					
Existing Buildings	**Schools**	**Retail**	**Data Centers**	**Warehouses and Distribution Centers**	**Hospitality**
15	15	15	15	15	15
Req	Req	Req	Req	Req	Req
2	2	2	2	2	2
3	2	3	3	3	3
2	2	2	2	2	2
1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1
N / A	1	N / A	N / A	N / A	N / A
Req	Req	Req	Req	Req	Req
Req	Req	Req	Req	Req	Req
2	2	2	2	2	2
5	5	5	4	5	5
3	3	3	4	3	3
2	2	2	2	2	2
Req	Req	Req	Req	Req	Req
Req	Req	Req	Req	Req	Req
Req	Req	Req	Req	Req	Req
Req	Req	Req	Req	Req	Req
2	2	2	2	2	2
2	2	2	2	2	2
3	3	3	3	3	3
20	20	20	20	20	20

TABLE 3 (CONTINUED). Credit Attributes

Category	Prerequisite/ Credit	Credit Name	Eligibility		Exemplary Performance
			Campus Approach	Group Approach	
EA	C	Advanced Energy Metering	-	-	no
EA	C	Demand Response	-	G	no
EA	C	Renewable Energy and Carbon Offsets	-	G	yes
EA	C	Enhanced Refrigerant Management	-	-	no
MR Materials and Resources					
MR	P	Ongoing Purchasing and Waste Policy	C	G	no
MR	P	Facility Maintenance and Renovation Policy	C	G	no
MR	C	Purchasing - Ongoing	-	G	yes
MR	C	Purchasing - Lamps	-	G	yes
MR	C	Purchasing - Facility Management and Renovation	-	G	yes
MR	C	Solid Waste Management - Ongoing	-	G	yes
MR	C	Solid Waste Management - Facility Maintenance and Renovation	-	G	yes
EQ Indoor Environmental Quality					
EQ	P	Minimum Indoor Air Quality Performance	-	-	no
EQ	P	Environmental Tobacco Smoke Control	C	G	no
EQ	P	Green Cleaning Policy	Opt 1 – YES Opt 2- no	G	no
EQ	C	Indoor Air Quality Management Program	-	G	no
EQ	C	Enhanced Indoor Air Quality Strategies	-	-	yes
EQ	C	Thermal Comfort	-	-	no
EQ	C	Interior Lighting	-	G	no
EQ	C	Daylight and Quality Views	-	-	yes
EQ	C	Green Cleaning--Custodial Effectiveness Assessment	-	-	no
EQ	C	Green Cleaning--Products and Materials	no	G	yes
EQ	C	Green Cleaning--Equipment	-	G	yes
EQ	C	Integrated Pest Management	C	G	no
EQ	C	Occupant Comfort Survey	-	-	no
IN Innovation					
IN	C	Innovation	C	G	no
IN	C	LEED Accredited Professional	-	G	no
RP Regional Priority					
RP	C	Regional Priority	-	-	no

Points					
New Construction	**Schools**	**Retail**	**Data Centers**	**Warehouses and Distribution Centers**	**Hospitality**
2	2	2	2	2	2
3	3	3	3	3	3
5	5	5	5	5	5
1	1	1	1	1	1
Req	Req	Req	Req	Req	Req
Req	Req	Req	Req	Req	Req
1	1	1	1	1	1
1	1	1	1	1	1
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
Req	Req	Req	Req	Req	Req
Req	Req	Req	Req	Req	Req
Req	Req	Req	Req	Req	Req
2	2	2	2	2	2
2	2	2	2	2	2
1	1	1	1	1	1
2	2	2	2	2	2
4	4	4	4	4	4
1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1
2	2	2	2	2	2
1	1	1	1	1	1
5	5	5	5	5	5
1	1	1	1	1	1
4	4	4	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 was not constructed by the owner of the LEED project for the express purpose of constructing 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 either included or not included in the certification of the LEED project.
  - If another building within the LEED project boundary is eligible for LEED certification, it may be either included or not included in the certification. If included, the project must be registered as a group certification project and the LEED campus certification process must be used.
- Sites with a master plan and/or phased development must designate a LEED project boundary for each LEED project.
- 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 entire building and complete scope of work.
- 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.
- Buildings that are physically connected by programmable space are considered one building for LEED purposes unless they are physically distinct and have distinct identities as separate buildings or if they are a newly constructed addition. If separated, the projects should also have separate air distribution systems and water and energy meters (including thermal energy meters).
- Buildings that have no physical connection or are physically connected only by circulation, parking, or mechanical/storage rooms are considered separate buildings and individual projects for LEED purposes, with the following exceptions:
  - Primary and secondary school projects, hospitals (general medical and surgical), hotels, resorts, and resort properties, as defined by ENERGY STAR building rating purposes, may include more than one physically distinct building in a single LEED project. For new construction projects, each building in the application must be less than 25,000 sq. ft. Please contact USGBC if with any questions.
  - For other cases such as buildings that 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), project teams are encouraged to contact USGBC to discuss their project prior to proceeding.

Interiors

- The LEED project should be defined by a clear boundary such that the LEED project is physically distinct from other interior spaces within the building.

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. 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). Must include the entire building's gross floor area in the project.

- **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. High-rise residential buildings 4 stories or more can use New Construction or Multifamily Midrise.
- **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 or more occupiable stories above grade. The building must have 50% or more residential space. These buildings may also use LEED BD+C: New Construction.

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.

Buildings that are fully operational and occupied for at least one year. The project may be undergoing *improvement* work or little to no construction. Must include the entire building's gross floor area in the project.

- **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.

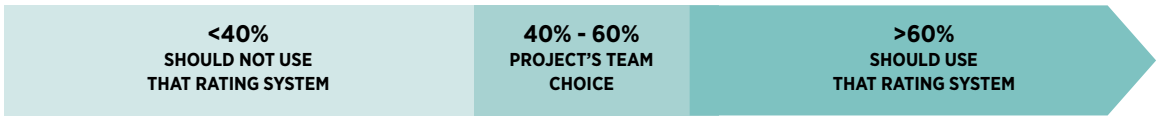
- **LEED ND: Plan.** Projects in conceptual planning or master planning phases, or under construction.
- **LEED ND: Built Project.** Completed development projects.

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



- 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 building location and how that location affects commuting patterns. The transportation sector is responsible for about one-quarter of energy-related greenhouse gas emissions worldwide,[1] and these emissions increased 17.5% from 1990 to 2010.[2] A significant portion of these emissions come from conventional commuting—that is, commuting in a single-occupancy vehicle that runs on conventional fossil fuel. Transportation infrastructure and commuting patterns are often intertwined with land-use patterns, and decentralized, disjointed transportation infrastructure can contribute to sprawling, inefficient land development. Thus, alternative transportation is an important part of a project's overall environmental performance.

Understanding the transportation patterns of tenants and providing transportation demand management tools are important first steps, but tracking building occupants' behavior is essential to determining whether projects are achieving results. Building operators and owners who are well informed about their occupants' travel patterns will be able to develop policies and incentives that can encourage changes in transportation habits.

1. *International Council on Clean Transportation, Passenger Vehicles, theicct.org/passenger-vehicles (accessed March 22, 2013).*
2. *cta.ornl.gov/data/chapter11.shtml, Table 11.7.*

Sustainable Sites (SS)

OVERVIEW

The Sustainable Sites (SS) category rewards decisions about the environment surrounding the building, with credits that emphasize the vital relationships among buildings, ecosystems, and ecosystem services. It focuses on restoring project site elements, integrating the site with local and regional ecosystems, and preserving the biodiversity that natural systems rely on.

Earth's systems depend on biologically diverse forests, wetlands, coral reefs, and other ecosystems, which are often referred to as "natural capital" because they provide regenerative services. A United Nations study indicates that of the ecosystem services that have been assessed worldwide, about 60% are currently degraded or used unsustainably.[1] The results are deforestation, soil erosion, a drop in water table levels, extinction of species, and rivers that no longer run to the sea. Recent trends like exurban development and sprawl encroach on the remaining natural landscapes and farmlands, fragmenting and replacing them with dispersed hardscapes surrounded by nonnative vegetation. Between 1982 and 2001 in the U.S. alone, about 34 million acres (13 759 hectares) of open space (an area the size of Illinois) was lost to development—approximately 4 acres per minute, or 6,000 acres a day.[2] The rainwater runoff from these hardscape areas frequently overloads the capacity of natural infiltration systems, increasing both the quantity and pollution of site runoff. Rainwater runoff carries such pollutants as oil, sediment, chemicals, and lawn fertilizers directly to streams and rivers, where they contribute to eutrophication and harm aquatic ecosystems and species. A Washington State Department of Ecology study noted that rainwater runoff from roads, parking lots, and other hardscapes carries some 6.3 million gallons of petroleum into the Puget Sound every year—more than half of what was spilled in the 1989 *Exxon Valdez* accident in Alaska.[3]

Project teams that comply with the prerequisites and credits in the SS category use low-impact development methods that minimize construction pollution, reduce heat island effects and light pollution, and mimic natural water flow patterns to manage rainwater runoff.

In LEED v4, the SS category combines traditional approaches with several new strategies. These include working with conservation organizations to target financial support for off-site habitat protection (Site Development—

1. *UN Environment Programme, State and Trends of the Environment 1987–2001, Section B, Chapter 5, unep.org/geo/geo4/report/05_Biodiversity.pdf.*
2. *U.S. Forest Service, Quick Facts, fs.fed.us/projects/four-threats/facts/open-space.shtml (accessed September 11, 2012).*
3. *Cornwall, W., Stormwater's Damage to Puget Sound Huge, Seattle Times (December 1, 2007), seattletimes.com/html/localnews/2004045940_ecology01m.html (accessed on September 14, 2012).*

Protect or Restore Habitat credit), using low-impact development to handle a percentile storm event (Rainwater Management credit), using three-year aged SRI values for roofs and SR values for nonroof hardscape (Heat Island Reduction credit), and creating a five-year improvement plan for the project site (Site Improvement Plan credit).

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.

Conservation and the 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 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 non-potable 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.

CROSS-CUTTING ISSUES

The WE category comprises three major components: indoor water (used by fixtures, appliances and processes, such as cooling), irrigation water, and water metering. Several kinds of documentation span these components, depending on the project's specific water-saving strategies.

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/en/ (accessed July 9, 2014).*
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).*

Site plans: Plans are used to document the location and size of vegetated areas, and the locations of meters and submeters. Within the building, floorplans show the location of fixtures, appliances, and process water equipment (e.g., cooling towers, evaporative condensers), as well as indoor submeters. The same documentation can be used in credits in the Sustainable Sites category.

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.

Alternative water sources: A project that includes graywater reuse, rainwater harvesting, municipally supplied wastewater (purple pipe water), or other reused sources, is eligible to earn credit in WE Credit Outdoor Water Use Reduction, WE Credit Indoor Water Use Reduction, WE Credit Cooling Tower Water Use, and WE Credit Water Metering. But the team cannot apply the same water to multiple credits unless the water source has sufficient water volume to cover the demand of all the uses (e.g., irrigation plus toilet-flushing demand).

Occupancy calculations: The Indoor Water Use Reduction prerequisite and credit require projections based on occupant's usage. The Location and Transportation and Sustainable Sites categories also use 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.

METERING AND TRACKING

The WE credits have significant synergies between installing water meters and documenting savings. Table 1 details the role of water meters in the WE credits.

TABLE 1. Water metering requirements

WE prerequisite or credit	Metering requirement or option	Reading frequency	Baseline length	Performance period length	Credit requirement	Reporting method
Prerequisite Indoor Water Use Reduction	Option 2, Metered Water Use: at least 80% of fixtures and fittings	Monthly summaries	12 months	12 months	No increase in water usage from baseline	Form
Prerequisite Building Level Water Metering	Whole building and associated grounds	Monthly summaries			Install meter, report data	Third-party data tool, USGBC-approved template
Credit Outdoor Water Use Reduction	Option 3, Irrigation Meter Installed	Monthly summaries	At least 3 years	12 months	Show 30% reduction from baseline	Form
Credit Indoor Water Use Reduction	Option 2, Metered Water Use: at least 80% of fixtures and fittings	Monthly summaries	12 months	12 months	Show reduction from baseline	Form
Credit Cooling Tower Water Use	None; cooling towers can be metered for points under WE Credit Water Metering					
Credit Water Metering	Irrigation, indoor plumbing fixtures and fittings, cooling towers, domestic hot water, reclaimed water, other process water	Weekly, including whole-building meter			Install meters; record data at least weekly and report; analyze time trends	Third-party data tool, USGBC-approved template, form

Energy and Atmosphere (EA)

OVERVIEW

The Energy and Atmosphere (EA) category approaches energy from a holistic perspective, addressing energy use 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.

A well-run facility is not only more energy efficient but also more healthful and comfortable for its occupants. In existing buildings, the focus is on improving building operations. Through the auditing or commissioning process, inefficiencies and opportunities for improvement are identified and prioritized, generally according to cost and benefit. The many no- and low-cost items often uncovered during this process can generate savings and efficiencies without significant capital investment. In an operationally effective and efficient building, the staff understands what systems are installed and how they function. Metering and ongoing commissioning allow staff to track energy use and identify issues on a consistent basis. Staff must have training, both initially and on a continuing basis, so that they can learn new methods for optimizing system performance.

Existing building commissioning is generally a set of discrete tasks that include monitoring system performance, executing functional tests, and verifying equipment operation. The timeline of these activities can extend anywhere from six to 18 months, depending on staff time, seasonal variations, and identified issues. Ongoing commissioning organizes those tasks into a repeating cycle of 24 months or less over the lifetime of the building. Some aspects of monitoring-based commissioning, including submetering, point trending, and energy analysis, can be incorporated into an ongoing commissioning program to help improve the process and identify issues in real time.

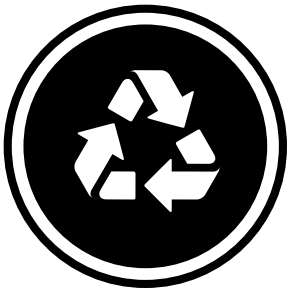
1. *iea.org/publications/freepublications/publication/kwes.pdf*
2. *cnx.org/content/m16730/latest/*
3. *unep.org/sbci/pdfs/SBCI-BCCSummary.pdf*

The commissioning process is focused on making the project building run as efficiently and use as little energy as possible; supplying that remaining energy use from renewables on the project site or purchased green power goes a step beyond. Nonfossil fuel energy helps balance the demand on traditional sources and reduce greenhouse gas emissions.

The EA category recognizes that the reduction of fossil fuel use extends far beyond the walls of the building. Projects can contribute to increasing the electricity grid's efficiency by enrolling in a demand response program. Demand response allows utilities to call on buildings to decrease their electricity use during peak times, reducing the strain on the grid and the need to operate more power plants, thus potentially avoiding the costs of constructing new plants. Permanent peak loading shifting addresses many of the same issues as demand response but results in demand reduction on a continuous basis, rather than just when an event is called.

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 replaced, the growth in energy demand by 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, Chapter 3, Buildings* (*American Physical Society, September 2008*), *aps.org/energyefficiencyreport/report/energy-bldgs.pdf* (*accessed September 13, 2012*).



Materials and Resources (MR)

OVERVIEW

The longest part of a building's life cycle is the use phase, commonly referred to as the operations phase. To target environmental impact reductions during building operations, the Materials and Resources (MR) credit category focuses on the constant flow of products being purchased and discarded to support building operations. The life cycle of these products and materials—from extraction, processing, and transportation to use and disposal—can cause a wide range of environmental and human health harms. To reduce these burdens and thus the overall impact of a building during its operations phase, project teams should take a close look at the purchasing and waste management operations in existing buildings.

PURCHASING FOR BUILDING MAINTENANCE AND RENOVATION

Although renovations to existing buildings generally cause less harm than new construction, the associated materials have already had a significant environmental impact by the time they arrive on site. The extraction or harvesting, manufacture, and transport of these materials contribute to water and air pollution, the degradation of habitats, and the depletion of natural resources. In addition, the introduction of volatile organic compounds (VOCs) and other contaminants to the site can degrade the building's indoor environmental quality before occupancy begins. Establishing an environmentally preferred purchasing policy for construction materials used for maintenance and renovations not only ensures a consistent approach to material selection but also helps reduce environmental harm by specifying low-VOC, sustainably harvested, or reused materials. Implementing such a policy creates the market demand needed to drive manufacturers to produce materials in a more environmentally preferable way.

PURCHASING FOR ONGOING OPERATIONS

In addition to the big expenses incurred during facility maintenance and renovations, buildings also require significant amounts of products, from floor wax to furniture to toilet paper, to ensure smooth operations. Though often overlooked, these ongoing purchases can have a large environmental impact. Like construction materials,

the products are associated with environmental burden both before and after they are used in the building. Unlike construction materials, however, these ongoing purchases are often the responsibility of several individuals in different departments, locations, and sometimes companies. An environmental purchasing plan, with procedures, guidelines, and designated responsibilities, is therefore necessary. This MR section addresses both the purchasing and implementation challenges facing existing building projects.

WASTE FOR BUILDING OPERATIONS

A significant amount of waste is generated by daily building operations and maintenance activities. Landfill disposal has wide-ranging effects, including soil and groundwater contamination, release of methane and carbon dioxide, and land degradation. Today commercial and institutional buildings typically account for 35% to 45% of total municipal solid waste. The commercial building industry can greatly reduce waste going to landfills and incinerators by targeting two large categories: paper (office paper, paperboard, cardboard) and organics (yard trimmings, food scraps, and wood).

Another important ongoing maintenance waste stream to consider is hazardous waste. One of the most toxic and most common sources of indoor pollution is mercury, which is found in all fluorescent lamps. Standard fluorescent lamps offer high efficiency and long life and are therefore widely used; they light 96% of commercial floor space in the United States.[1] Once removed from a building, they often become part of the municipal solid waste stream and contribute to air, land, and water contamination. Properly storing both new and spent lamps on site and ensuring their safe disposal reduce the environmental damage.

Both building maintenance and renovation inevitably produce construction and demolition waste. The safe storage, installation, and disposal of base building elements, such as carpets, paint, casework, furniture, and lamps, contribute to a healthy environment inside and outside the building. Because renovation and maintenance activities can affect indoor air quality, it is important to comply with safe storage recommendations for materials and follow correct protocols when painting, installing carpets, and working with other base building elements. Reducing contamination during construction and before occupancy can help minimize potential problems, thereby enhancing occupants' comfort, lowering absenteeism, and improving productivity. Taking time during construction to clean and protect ventilation systems and building spaces can extend the lifetime of ventilation systems and improve their efficiency, reducing energy use.

CROSS-CUTTING ISSUES

REQUIRED PRODUCTS AND MATERIALS

Each prerequisite and credit outlines the exact scope of the requirements. The prerequisite and credit requirements are divided into two categories: products that are purchased on an ongoing basis, such as lamps, paper goods, or office equipment, and materials purchased for periodic maintenance or renovation work.

QUALIFYING PRODUCTS AND EXCLUSIONS

The MR section related to maintenance and renovation addresses "permanently installed building products," which as defined by LEED refers to 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 roof. 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.

For the Operations and Maintenance rating system, furniture must be included in credit calculations and treated consistently across credits. Also included are items purchased to maintain furniture.

Excluded from MR credits are all mechanical, plumbing, and electrical equipment (MEP), specialty items (e.g., elevators, escalators, process equipment, fire suppression systems), and products purchased for temporary use on the project (e.g., formwork for concrete).

1. *U.S. Department of Energy. 2003 Commercial Buildings Energy Consumption Survey, 2006, http://www.eia.gov/emeu/cbecs2003/detailed_tables_2003/detailed_tables_2003.html (accessed May 2008)*

DETERMINING PRODUCT COST

Calculations for purchasing credits are based on product and material cost, which excludes labor required for installation or replacement. Preferably, taxes, shipping, and delivery costs on purchases should be excluded but may be included, provided they are either included or excluded consistently throughout the calculations.

DETERMINING MATERIAL CONTRIBUTIONS OF AN ASSEMBLY

Many sustainable 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 1, Table 1).

Product value ($) = Total product cost ($) x % meeting sustainble criteria

Figure 1. 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

SELECTING AN APPROPRIATE PURCHASING TRACKING SYSTEM

Several credits in the MR section depend on tracking product purchasing decisions and materials types or streams. When deciding on a tracking system, make sure that the strategy works for the project team. A good tracking system is user-friendly, readily accessible, and easily coordinates multiple purchases from a variety of sources. Issues to consider include users' computer skills and accessibility, language barriers, and the need to merge information from multiple sources.

For example, if many individuals make purchases, an electronic tracking system may make it easier to share or combine purchase data. Standardized tracking tools ease the process of tracking the purchases of different parties and aggregating the data. Keep in mind that some vendors may not have ready access to computers for logging product deliveries.

Steps for using a tracking system proceed as follows:

1. Review current purchasing practices to evaluate which items already meet the requirements and what changes need to be made.
2. Log all purchases.
3. Identify which purchases meet the credit criteria.
4. Calculate the percentage, by cost, of portions of materials or assemblies that meet the criteria (in those cases where only a portion of a material meets the criteria).
5. Calculate the total percentage, by cost, of materials that meet the credit criteria.

It is recommended that teams pilot the chosen tracking system for one or two months before using it for LEED certification so that any problems can be addressed before the performance period.

MULTITENANT BUILDINGS

Because certification applies to whole buildings, it may be challenging for multitenant buildings to earn certain credits, especially in the MR category. All portions of a building under the site management's control are expected to comply with the credit requirements. If it is not possible to gather to necessary information on purchasing or waste management to document credit achievement, or if the LEED applicant does not have control over the entire building, the project team may exempt up to 10% of the building's gross floor area (see *Getting Started*). Multifamily buildings are allowed to exclude resident purchasing from tracking completely. If a multifamily building is mixed use, the nonresidential portions of the building must still include a minimum of 90% of the area in credit calculations.

Collecting waste information in multitenant buildings. Generally, waste collection falls under the responsibility of building management, through a service contract for the entire building. If waste collection or portions of waste collection (e.g., hazardous waste) are not under the site management's control, it is recommended that teams prioritize meeting local regulations for waste disposal, then focus on prerequisite achievement and, last, credit achievement.

Collecting purchasing information in multitenant buildings. The products, materials, and furniture (as applicable) purchased by tenants are included in the MR purchasing credits. It is recommended that project teams test the building-wide purchasing tracking systems before the start of the performance period. Establish a relationship with the primary purchaser in each tenant space to encourage participation, accurate reporting, and notification when relevant purchases will be made. Provide support (e.g., training in using the tracking tool) and clearly indicate what information is needed.

Excluding tenant purchases in credit documentation. If additional tenants beyond those in the excluded 10% gross floor area choose not to provide purchasing data, the purchases for those tenant spaces must be estimated and assumed to be noncompliant. To estimate these tenants' purchases, extrapolate the purchasing rate from elsewhere in the building on a per occupant or area basis, and assume that the purchases meet none of the criteria. Integrate the estimated data from the nonparticipating tenants into the whole-building purchasing data (for participating and nonparticipating tenants) to determine compliance for the whole building (Table 2).

TABLE 2. Example compliance calculation with nonparticipating tenants

Actual purchase rate for participating tenants			
Tenant	**Floor area (ft^2)**	**Total purchases**	**Compliant purchases**
Jones Hotelier	75,000	$2,000	$1,500
Big Red Offices	60,000	$1,000	$750
Total	135,000	$3,000	$2,250
Total purchases / ft^2 of participating tenants			$0.022

Estimated purchase rate for nonparticipating tenants			
Tenant	**Floor area (ft^2)**	**Estimated total purchases**	**Estimated compliant purchases**
Cranky's Depot	15,000	$0.022 x 15,000 ft^2 = $330	$0

Whole-building results			
Tenant	**Floor area (ft^2)**	**Total purchases**	**Compliant purchases**
Jones Hotelier	75,000	$2,000	$1,500
Big Red Offices	60,000	$1,000	$750
Cranky's Depot (estimated)	15,000	$330	$0
Total	150,000	$3,330	$2,250
Percentage compliant purchases			67.57%

Indoor Environmental Quality (EQ)

OVERVIEW

The Indoor Environmental Quality (EQ) category rewards decisions made by project teams about indoor air quality, thermal and visual comfort, and occupants' satisfaction. 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]

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] The EQ section encourages project teams to develop policies and programs based on proven methods that prioritize the health and comfort of the building occupants and to measure performance with well-established indicators.

Ventilation has a large effect on the health and well-being of a building's occupants. Existing buildings' HVAC systems may have fallen out of calibration or were never designed to provide adequate amounts of outside air for diluting contaminants. The EQ section focuses on optimizing existing HVAC systems and minimizing sources of contaminants, such as cleaning products and laser printers. (Emissions from products used in renovations, maintenance work, and furniture are addressed in the Materials and Resources credit category.) The EQ category also encourages building owners to determine priorities for improving the indoor environment by surveying occupants.

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 • Enhanced Indoor Air Quality Strategies, Option 2, Filtration (Existing Buildings, Schools, Retail, Hospitality, Warehouses & Distribution Centers) • Thermal Comfort, design requirements (Existing Buildings, Schools, Retail, Hospitality, Warehouses & Distribution Centers)
Regularly occupied space	• Enhanced Indoor Air Quality Strategies, Option 2, Filtration (Data Centers) • Thermal Comfort, design requirements (Data Centers) • 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 and Quality Views
Individual occupant space	• Interior Lighting, Option 1
Shared multioccupant space	• Interior Lighting, Option 1
Densely occupied space	• Enhanced Indoor Air Quality Strategies, Option 2 Carbon Dioxide Monitors

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	• Thermal Comfort, control requirements* • Interior Lighting*
Warehouses and Distribution Centers	Office areas	• Daylight and Quality Views, Option 2
Warehouses and Distribution Centers	Areas of bulk storage, sorting, and distribution	• Daylight and Quality Views, Option 2

*Hotel guest rooms are excluded from the credit requirements.

The following credits are not affected by space classifications:

- Environmental Tobacco Smoke Control
- Green Cleaning Policy
- Indoor Air Quality Management Program
- Enhanced Indoor Air Quality Strategies, Option 1
- Enhanced Indoor Air Quality Strategies, Option 2, Outdoor Air Monitoring for Mechanically Ventilated Spaces
- Enhanced Indoor Air Quality Strategies, Option 2 Outdoor Air Monitoring for Naturally Ventilated Spaces
- Enhanced Indoor Air Quality Strategies, Option 2, Alarmed Openings for Naturally Ventilated Spaces
- Interior Lighting, Option 2, Lighting Quality, strategy B
- Interior Lighting, Option 2, Lighting Quality, strategy C
- Interior Lighting, Option 2, Lighting Quality, strategy F
- Green Cleaning—Custodial Effectiveness Assessment
- Green Cleaning—Products and Materials
- Green Cleaning—Equipment
- Integrated Pest Management
- Occupant Comfort Survey

TRICKY SPACES

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

Residential

- Minimum Indoor Air Quality Performance and Environmental Tobacco Smoke have specific requirements and considerations for residential projects.
- See the *Project Type Variations* sections in 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.
- An exception to the views requirements in Daylight and Quality Views is permitted. See the *Project Type Variations* section in Daylight and Quality Views.

Transportation Terminals

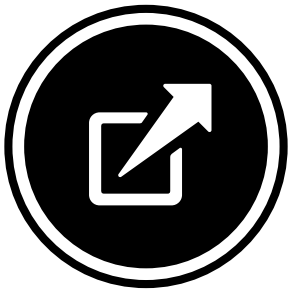
- For Interior Lighting, Option 1, Lighting Control, most of the areas in a transportation terminal can be considered shared multioccupant. Most areas in transportation terminals are also regularly occupied.

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 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

Strategies for sustainable building operations are constantly evolving and improving. New technologies that improve building operations and maintenance are continually introduced to the marketplace. The purpose of this LEED category is to recognize projects for innovative and exemplary building features or practices that generate environmental benefits beyond those addressed or specified in the other credit categories.

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., wa-ter 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 rat-ing 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 ≤ 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*$H^{-0.258}$ + 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*$H^{-0.326}$ + 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*$H^{-0.326}$ + 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
Glass-door reach-in freezer, 1.42 ≤ V m^3	Elec	Refrig	26.50V + 4.1 kWh/day	na	≤ 15.90V + 3.50 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 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 ≤ 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 ≤ 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 ≤ 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 ≤ 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 ≤ 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 ≤ 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 ≤ 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 ≤ 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