REFERENCE GUIDE FOR HOMES DESIGN AND CONSTRUCTION

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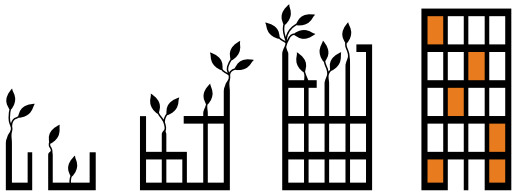


THE CASE FOR GREEN BUILDING

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

The forces driving this situation are several. Human population has increased exponentially in the past 60 years, from about 2.5 billion in 1950 to more than 7 billion today. A consumption life-cycle of extraction, use, and disposal has accelerated depletion of finite supplies of nonrenewable energy, water, and materials. The depletion of such resources is anticipated to worsen as standards of living in developing countries rise. The linear use of resources that treats outputs as waste has triggered an accumulation of toxins in the atmosphere and on Earth's surface. Taken together, all of these forces are creating a tipping point, a threshold beyond which the planet cannot rebalance without major disruption to the systems that humans and other species rely on for survival.

The LEED® Green Building Rating System™ was developed to address those concerns. The U.S. Green Building Council realized that the building design and construction industry already had the science, expertise, tools, and technology to transform the industry and make significant advances toward a sustainable world, but it needed a standard for high-quality, long-lasting structures that would use fewer resources and promote both ecosystem and human health. Taking a green design approach, LEED projects throughout the world have already demonstrated benefits to the sustainable balance of natural systems.

The residential building sector has a significant role to play in sustainability through its development patterns, construction strategies, and lifetime of operation. As the earth's population continues to increase, construction and gut-rehabilitation of homes grow with it. Estimates for U.S. building construction indicate that 89 million new or replaced homes will be constructed between 2007 and 2050.[2] What we build today and where we build it are profoundly important.

1. *Global Footprint Network, footprintnetwork.org/en/index.php/gfn/page/world_footprint/, accessed 9/11/2012*
2. *R. Ewing, k. Bartholomew, S. Winkleman, J. Walters, D. Chen, Growing Cooler, The Evidence on Urban Development and Climate Change, (Washington, D.C., Urban Land Institute, 2008) , pg 8 smartgrowthamerica.org/documents/growingcoolerCH1.pdf*

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, consensus-based tool which 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 impacts of the buildings industry, and provide high quality indoor environments for building occupants. LEED emphasizes integrated design, appropriate integration of existing technology, and the use of state of the art strategies to advance expertise in green building and transform professional practice.

LEED is voluntary, consensus-based, and market-driven. The technical basis on which LEED is built seeks a balance between requirement of existing best practice and voluntary incorporation of leadership strategies. LEED sets a challenging yet achievable set of whole building and neighborhood benchmarks that define green building.

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 were developed to meet the needs of different market sectors. LEED for Homes was officially launched in 2008, and LEED for Multifamily Midrise was piloted that year.

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 impacts of the built environment. These ongoing improvements to LEED are developed by USGBC member-based volunteer committees, subcommittees, and working groups, in conjunction with USGBC staff, and are then subject to review and approval by the LEED Steering Committee and the USGBC Board of Directors prior to a vote by USGBC membership. The development 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 BD+C 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

To earn certification, projects must meet the requirements of all mandatory measures (prerequisites), achieve enough points to meet or exceed minimum point floors for applicable credit categories, and earn at least 40 total points.

There are four possible levels of certification that can be achieved by exceeding the following point thresholds:

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

Point floors are included in some sections of the rating system, setting a minimum threshold for number of points that must be earned in that particular section. Point floors are included in the following credit categories:

- 3 points in Water Efficiency
- 8 points combined in Location and Transportation and Energy and Atmosphere
- 3 points in Indoor Environmental Quality

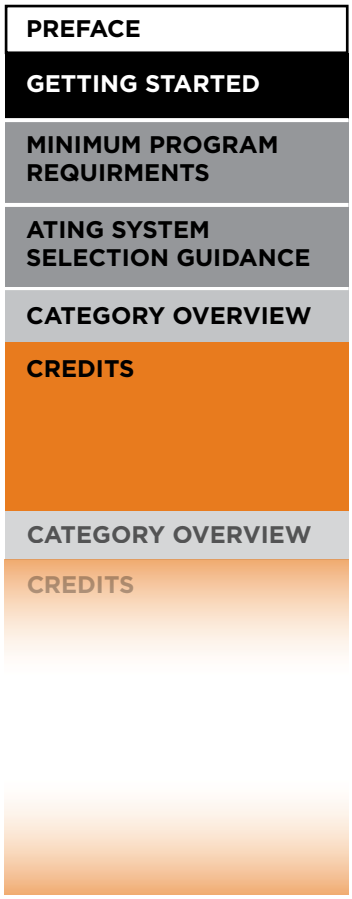
REFERENCE GUIDE OVERVIEW

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 that topic. The credits list the requirements for achievement. Readers will then find the following sections in each credit section:

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 general information on the credit requirements.

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 additional guidance for lengthy calculations or for special project situations, such as tips for nonstandard project types or credit approaches. It sometimes includes an *International Tips* section.

RELATED CREDIT TIPS
other credits that will affect their decisions and strategies for the credit in question; the relationships between credits may imply synergies or trade-offs.

CHANGES FROM LEED FOR HOMES 2008
indicates the changes since the 2008 version of the LEED for Homes rating system.

CONTRACT LANGUAGE RECOMMENDATIONS
gives examples of language that the builder or developer can use in agreements with contractors.

REFERENCED STANDARDS
lists all standards related to the credit and offers web links to find them.

VERIFICATION & SUBMITTALS
outlines the supporting verification materials and submittals required from the project team and the required verification to be completed by the verification team.

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 work in conjunction with the rating system. Written by expert users of LEED, it serves as a roadmap, describing the steps tied directly to documenting credit requirements and offering additional 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 across the guide.

CREDIT CATEGORIES

INTEGRATIVE PROCESS

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)

PROJECTS OUTSIDE THE U.S.

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

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

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

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

LEED WORK PLAN

STEP 1. CONNECT WITH GREEN RATER ORGANIZATION

A LEED Green Rater is responsible for verification of all prerequisites and credits in the LEED residential rating systems. The Green Rater performs on-site verification and conducts diagnostic testing to ensure that the team's strategies are effective. All projects are required to have a preliminary rating meeting with the Green Rater as early as possible in the design and construction process (Step 4). Green Raters are listed by location on the USGBC website.

A qualified energy rater is required to verify the energy components and, for LEED BD+C: Homes projects, run the energy model. Most Green Raters are also energy raters.

STEP 2. CHOOSE APPROPRIATE RATING SYSTEM

The residential rating systems address two kinds of residential construction: single-family and low-rise multifamily, and multifamily midrise. Throughout this reference guide, items marked "Homes" are generally appropriate for single-family buildings and low-rise multifamily buildings (up to three stories). Those marked "Multifamily Midrise" are for predominantly residential projects four stories or more above grade. Some requirements apply to both kinds of construction; for others, there are slight differences. See *Rating System Selection Guidance* in this reference guide for further details, particularly because certain four- and five- story projects may be appropriate for Homes rather than Multifamily Midrise.

STEP 3. CHECK PROJECT ELIGIBILITY

All projects seeking certification are required to comply with the Minimum Program Requirements and eligibility requirements for their applicable rating system, found on USGBC's website (also see *Minimum Program Requirements* in this reference guide).

Major "gut" rehab projects can achieve certification under LEED:BD+C Homes or Multifamily Midrise, but partial rehab or renovation projects cannot. To be considered a major rehab project, the home must be stripped to the studs on at least one side of all external walls and the exterior ceiling, to expose the interstitial space for insulation installation and inspection. The American Society of Interior Designers' Foundation and USGBC have partnered on the development of best practice guidelines and targeted educational resources for sustainable residential remodeling projects. This program will increase understanding of sustainable renovation project practices and benefits among homeowners, residents, design professionals, product suppliers, and service providers to build both demand and industry capacity. More information is available at regreenprogram.org.

STEP 4. DEFINE LEED PROJECT SCOPE

Review the project's program to determine the breadth of team influence and identify any potential limitations to certification. Considerations include the extent of the gut-rehab, if the project is an existing structure, or construction timeline (e.g., is the project already under construction?).

Next, map the LEED project boundary. In most cases, this is the property line or lot line. If the project's boundary is not obvious because of phasing, multiple ownership, or other issues, consult the Minimum Program Requirements.

STEP 5. DEVELOP LEED SCORECARD AND PRELIMINARY RATING

Establish the LEED rating that the project team desires (Certified, Silver, Gold, or Platinum) and identify supporting credits to achieve the desired rating. Make sure that all prerequisites can be met. This preliminary rating is a required first step; the Green Rater will help facilitate the preliminary rating.

Three categories—Location and Transportation, Water Efficiency, and Energy and Atmosphere—have both a prescriptive and a performance path. The project team needs to decide early on which path in each section is appropriate for the project. The Green Rater can guide the team in making this decision, taking into account the project team's goals, region, and previous experience.

Establishing a buffer of several points above the minimum required points helps ensure success in case changes in design and construction make certain credits unachievable.

STEP 6. ASSIGN ROLES AND RESPONSIBILITIES TO PROJECT TEAM

For the preliminary rating, select one team member to lead the group in setting sustainability goals and coordinating the overall documentation process for submittal to the Green Rater. Both the design and the construction representatives should be involved throughout the process to ensure consistency and clarity.

Team ownership of credit compliance can help foster integrated design while ensuring that documentation is generated consistently across credits. On a credit-by-credit basis, assign primary and supporting roles to appropriate team members for credit achievement and documentation. Although many items in LEED BD+C: Homes and Multifamily Midrise are visually verified on site by the Green Rater, other items are verified through design documents. Clarify responsibilities for ensuring that design decisions are accurately represented in drawings and specifications and that construction details match design documentation.

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

STEP 7. DEVELOP CONSISTENT DOCUMENTATION

Consistent documentation is critical to LEED certification. During construction, the team member with lead responsibility for documentation should ensure that other members provide the required plans, drawings, invoices, lists, descriptions, photographs, calculations, and other forms of documentation—as specified in the verification and submittals section for each credit. He or she should collect and save this documentation in a central location and ensure that it is secure and complete. Data should be recorded on a regular schedule to allow the team to track ongoing progress toward the credits. The Green Rater can advise the team on the completeness of the documentation.

STEP 8. SCHEDULE SITE INSPECTIONS FOR VERIFICATION

At a minimum, two site visits by the Green Rater and energy rater are required. The first site inspection is required after insulation has been installed but before drywall. The second is performed when the home and all landscaping are completed.

STEP 9. GREEN RATER REVIEW AND SUBMIT TO USGBC FOR CERTIFICATION

The Green Rater's review of the documentation is an essential part of certification. All credits must be verified by the Green Rater, through site inspections and review of documentation and calculations. If the Green Rater finds everything in order, he or she signs off and submits the project for quality assurance and USGBC certification review.

TABLE 1. Homes Project Checklist

Y	?	N				Possible points	Exemplary Performance available?
INTEGRATIVE PROCESS						**2**	1
			Credit 1	**Integrative Process**		2	
					Option 1. Integrative Project Team	1	
					Option 2. Design Charrette	1	
					Option 3. Trades Training	1	
LOCATION AND TRANSPORTATION						**15**	
			Prereq 1	**Floodplain Avoidance**		Required	NA
Performance Path							
			Credit 1	**LEED for Neighborhood Development**		15	NA
Prescriptive Path							
			Credit 2	**Site Selection**		8	1
					Option 1. Sensitive Land Protection	4	
					Path 1. Previously Developed	4	
					Path 2. Avoidance of Sensitive Land	3	
					Option 2. Infill Development	2	
					Option 3. Open Space	1	
					Option 4. Street Network	1	
					Option 5. Bicycle Network and Storage	1	
			Credit 3	**Compact Development**		3	1
			Credit 4	**Community Resources**		2	1
			Credit 5	**Access to Transit**		2	1
SUSTAINABLE SITES						**7**	
			Prereq 1	**Construction Activity Pollution Prevention**		Required	NA
			Prereq 2	**No Invasive Plants**		Required	NA
			Credit 1	**Heat Island Reduction**		2	1
					Option 1. Shading	2	
					Option 2. Nonabsorptive Materials	2	
			Credit 2	**Rainwater Management**		3	1
					Case 1. Low Impact Development	3	

					Case 2. National Pollutant Discharge Elimination System Projects	3	
			Credit 3	**Non-Toxic Pest Control**		2	1
WATER EFFICIENCY						**12**	
			Prereq 1	**Water Metering**		Required	NA
Performance Path							
			Credit 1	**Total Water Use**		12	1
Prescriptive Path							
			Credit 2	**Indoor Water Use**		6	NA
			Credit 3	**Outdoor Water Use**		4	NA
ENERGY AND ATMOSPHERE						**38**	
			Prereq 1	**Minimum Energy Performance**		Required	NA
			Prereq 2	**Energy Metering**		Required	NA
			Prereq 3	**Education of the Homeowner, Tenant or Building Manager**		Required	NA
Performance Path							
			Credit 1	**Annual Energy Use**		29	1
					Option 1. LEED Energy Budget	29	
					Option 2. HERS Index with Home Size Adjuster	29	
Both Paths							
			Credit 2	**Efficient Hot Water Distribution System**		5	NA
					Option 1. Efficient Hot Water Distribution	2	
					Path 1. Maximum Allowable Pipe Length	2	
					Path 2. Maximum Allowable Pipe Volume	2	
					Option 2. Performance Test	3	
					Case 1. Water heater or boiler with no circulation loop or heat traced pipe	3	
					Case 2. Circulation loop or heat traced pipe	3	
					Option 3. Pipe Insulation	2	
			Credit 3	**Advanced Utility Tracking**		2	NA
					Option 1. Electric and Water	1	
					Option 2. Third-Party Utility Reporting	1	
			Credit 4	**Active Solar-Ready Design**		1	1
					Option 1. Photovoltaic-Ready Design	1	

					Option 2. Solar Direct Hot Water- Ready Design	1	
			Credit 5	**HVAC Start-Up Credentialing**		1	NA
Prescriptive Path							
			Prereq 4	**Home Size**		Required	NA
			Credit 6	**Building Orientation for Passive Solar**		3	NA
			Credit 7	**Air Infiltration**		2	NA
			Credit 8	**Envelope Insulation**		2	NA
			Credit 9	**Windows**		3	NA
			Credit 10	**Space Heating & Cooling Equipment**		4	NA
			Credit 11	**Heating & Cooling Distribution Systems**		3	NA
					Case 1. Forced-Air System	3	
					Option 1. Ductwork in Conditioned Space	3	
					Option 2. Ductwork in Unconditioned Space	2	
					Case 2. Hydronic System	3	
			Credit 12	**Efficient Domestic Hot Water Equipment**		3	NA
			Credit 13	**Lighting**		2	NA
					Option 1. Indoor Lighting	1.5	
					Option 2. Exterior Lighting	0.5	
			Credit 14	**High-Efficiency Appliances**		2	NA
			Credit 15	**Renewable Energy**		4	1
MATERIALS AND RESOURCES						**10**	
			Prereq 1	**Certified Tropical Wood**		Required	NA
			Prereq 2	**Durability Management**		Required	NA
			Credit 1	**Durability Management Verification**		1	NA
			Credit 2	**Environmentally Preferable Products**		4	1
					Option 1. Local Production	1.5	
					Option 2. Environmentally Preferable Products	4	
			Credit 3	**Construction Waste Management**		3	1
			Credit 4	**Material-Efficient Framing**		2	1
INDOOR ENVIRONMENTAL QUALITY						**16**	
			Prereq 1	**Ventilation**		Required	NA
			Prereq 2	**Combustion Venting**		Required	NA

			Prereq 3	**Garage Pollutant Protection**		Required	NA
			Prereq 4	**Radon-Resistant Construction**		Required	NA
			Prereq 5	**Air Filtering**		Required	NA
			Prereq 6	**Environmental Tobacco Smoke**		Required	NA
			Prereq 7	**Compartmentalization**		Required	NA
			Credit 1	**Enhanced Ventilation**		3	NA
					Option 1. Enhanced Local Exhaust	1	
					Option 2. Enhanced Whole-House Ventilation	2	
			Credit 2	**Contaminant Control**		2	0.5
					Option 1. Walk-off Mats	0.5	
					Option 2. Shoe Removal and Storage	0.5	
					Option 3. Preoccupancy Flush	0.5	
					Option 4. Air Testing	1	
			Credit 3	**Balancing of Heating and Cooling Distribution Systems**		3	NA
					Case 1. Forced-Air Systems	3	
					Option 1. Multiple Zones	1	
					Option 2. Supply Air-Flow Testing	1	
					Option 3. Pressure Balancing	1	
					Case 2. Radiative Systems	2	
					Option 1. Multiple Zones	1	
					Option 2. Room-by-Room Controls	2	
			Credit 4	**Enhanced Compartmentalization**		1	NA
			Credit 5	**Enhanced Combustion Venting**		2	NA
					Option 1. No Fireplace or Woodstove	2	
					Option 2. Enhanced Combustion Venting Measures	1	
			Credit 6	**Enhanced Garage Pollutant Protection**		2	NA
					Case 1. Single Family	2	
					Option 1. Exhaust Fan in Garage	1	
					Option 2. No Garage, or Detached Garage, or Carport	2	
					Case 2. Multifamily	2	
					Option 1. Exhaust Fan in Multicar Garage	1	
					Option 2. Exhaust fan in Small Garage	1	

					Option 3. No Garage, or Detached Garage	2	
			Credit 7	**Low-Emitting Products**		3	NA
INNOVATION						**6**	
			Prereq 1	**Preliminary Rating**		Required	NA
			Credit 1	**Innovation**		5	NA
					Option 1. Innovation	1	
					Option 2. Pilot	1	
					Option 3. Additional Strategies	3	
					Innovation	1	
					Innovation	1	
					Innovation	1	
					Pilot	1	
					Pilot	1	
					Pilot	1	
					Exemplary Performance:	1	
					Exemplary Performance:	1	
					Exemplary Performance:	1	
			Credit 2	**LEED AP for Homes**		1	NA
REGIONAL PRIORITY						**4**	
			Credit 1	**Regional Priority: Specific Credit**		1	NA
			Credit 2	**Regional Priority: Specific Credit**		1	NA
			Credit 3	**Regional Priority: Specific Credit**		1	NA
			Credit 4	**Regional Priority: Specific Credit**		1	NA
TOTAL						**110**	

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

POINT FLOORS

Projects must earn at least 8 points in the combined LT and EA sections
Projects must earn at least 3 points in the WE section
Projects must earn at least 3 points in the EQ section

TABLE 2. Multifamily Midrise Project Checklist

Y	?	N				Possible points	Exemplary Performance available?
INTEGRATIVE PROCESS						**2**	
			Credit 1	**Integrative Process**		2	1
					Option 1. Integrative Project Team	1	
					Option 2. Design Charrette	1	
					Option 3. Trades Training	1	
LOCATION AND TRANSPORTATION						**15**	
			Prereq 1	**Floodplain Avoidance**		Required	NA
Performance Path							
			Credit 1	**LEED for Neighborhood Development**		15	NA
Prescriptive Path							
			Credit 2	**Site Selection**		8	1
					Option 1. Sensitive Land Protection	4	
					Path 1. Previously Developed	4	
					Path 2. Avoidance of Sensitive Land	3	
					Option 2. Infill Development	2	
					Option 3. Open Space	1	
					Option 4. Street Network	1	
					Option 5. Bicycle Network and Storage	1	NA
			Credit 3	**Compact Development**		3	1
			Credit 4	**Community Resources**		2	1
			Credit 5	**Access to Transit**		2	1
SUSTAINABLE SITES						**7**	
			Prereq 1	**Construction Activity Pollution Prevention**		Required	NA
			Prereq 2	**No Invasive Plants**		Required	NA
			Credit 1	**Heat Island Reduction**		2	1
					Option 1. Shading	2	
					Option 2. Nonabsorptive Materials	2	
			Credit 2	**Rainwater Management**		3	1
					Case 1. Low Impact Development	3	
					Case 2. National Pollutant Discharge Elimination System Projects	3	
			Credit 3	**Non-Toxic Pest Control**		2	1

WATER EFFICIENCY						**12**	
			Prereq 1	**Water Metering**		Required	NA
Performance Path							
			Credit 1	**Total Water Use**		12	1
Prescriptive Path							
			Credit 2	**Indoor Water Use**		6	NA
			Credit 3	**Outdoor Water Use**		4	NA
ENERGY AND ATMOSPHERE						**37**	
			Prereq 1	**Minimum Energy Performance**		Required	NA
			Prereq 2	**Energy Metering**		Required	NA
			Prereq 3	**Education of the Homeowner, Tenant or Building Manager**		Required	NA
Performance Path							
			Credit 1	**Annual Energy Use**		30	1
			Credit 2	**Efficient Hot Water Distribution System**		5	NA
					Option 1. Efficient Hot Water Distribution	2	
					Path 1. Maximum Allowable Pipe Length	2	
					Path 2. Maximum Allowable Pipe Volume	2	
					Option 2. Performance Test	3	
					Case 1. Water heater or boiler with no circulation loop or heat traced pipe	3	
					Case 2. Circulation loop or heat traced pipe	3	
					Option 3. Pipe Insulation	2	
			Credit 3	**Advanced Utility Tracking**		2	NA
					Option 1. Electric and Water	1	
					Option 2. Third-Party Utility Reporting	1	
MATERIALS AND RESOURCES						**9**	
			Prereq 1	**Certified Tropical Wood**		Required	NA
			Prereq 2	**Durability Management**		Required	NA
			Credit 1	**Durability Management Verification**		1	NA
			Credit 2	**Environmentally Preferable Products**		5	1
					Option 1. Local Production	1.5	
					Option 2. Environmentally Preferable Products	4	
			Credit 3	**Construction Waste Management**		3	1
INDOOR ENVIRONMENTAL QUALITY						**18**	
			Prereq 1	**Ventilation**		Required	NA
			Prereq 2	**Combustion Venting**		Required	NA
			Prereq 3	**Garage Pollutant Protection**		Required	NA

			Prereq 4	**Radon-Resistant Construction**		Required	NA
			Prereq 5	**Air Filtering**		Required	NA
			Prereq 6	**Environmental Tobacco Smoke**		Required	NA
			Prereq 7	**Compartmentalization**		Required	NA
			Credit 1	**Enhanced Ventilation**		3	NA
					Option 1. Enhanced Local Exhaust	1	
					Option 2. Enhanced Whole-Unit Ventilation	2	
			Credit 2	**Contaminant Control**		2	0.5
					Option 1. Walk-off Mats	0.5	
					Option 2. Shoe Removal and Storage	0.5	
					Option 3. Preoccupancy Flush	0.5	
					Option 4. Air Testing	1	
			Credit 3	**Balancing of Heating and Cooling Distribution Systems**		3	NA
					Case 1. Forced-Air Systems	3	
					Option 1. Multiple Zones	1	
					Option 2. Supply Air-Flow Testing	1	
					Option 3. Pressure Balancing	1	
					Case 2. Radiative Systems	3	
					Option 1. Multiple Zones	1	
					Option 2. Room-by-Room Controls	2	
			Credit 4	**Enhanced Compartmentalization**		3	NA
			Credit 5	**Combustion Venting**		2	NA
					Option 1. No Fireplace or Woodstove	2	
					Option 2. Enhanced Combustion Venting Measures	1	
			Credit 6	**Enhanced Garage Pollutant Protection**		1	NA
					Option 1. Exhaust Fan on Controls in Garage	1	
					Option 2. Detached Garage or No Garage or Carport	1	
			Credit 7	**Low-Emitting Products**		3	NA
			Credit 8	**No Environmental Tobacco Smoke**		1	NA
INNOVATION						**6**	
			Prereq 1	**Preliminary Rating**		Required	NA
			Credit 1	**Innovation**		5	NA
					Option 1. Innovation	1	
					Option 2. Pilot	1	
					Option 3. Additional Strategies	3	
					Innovation	1	

					Innovation	1	
					Innovation	1	
					Pilot	1	
					Pilot	1	
					Pilot	1	
					Exemplary Performance:	1	
					Exemplary Performance:	1	
					Exemplary Performance:	1	
			Credit 2	**LEED AP for Homes**		1	NA
REGIONAL PRIORITY						**4**	
			Credit 1	**Regional Priority: Specific Credit**		1	NA
			Credit 2	**Regional Priority: Specific Credit**		1	NA
			Credit 3	**Regional Priority: Specific Credit**		1	NA
			Credit 4	**Regional Priority: Specific Credit**		1	NA
TOTAL						**110**	

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

POINT FLOORS

Projects must earn at least 8 points in the combined LT and EA sections
Projects must earn at least 3 points in the WE section
Projects must earn at least 3 points in the EQ section

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 as outlined in USGBC's campus guidance.
- Projects that are phased sites with a master plan for multiple buildings must designate a LEED project boundary for each building or follow USGBC's campus guidance.
- The gross floor area of the LEED project should be no less than 2% of the gross land area within the LEED project boundary.

Building

- The LEED project should include the 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.

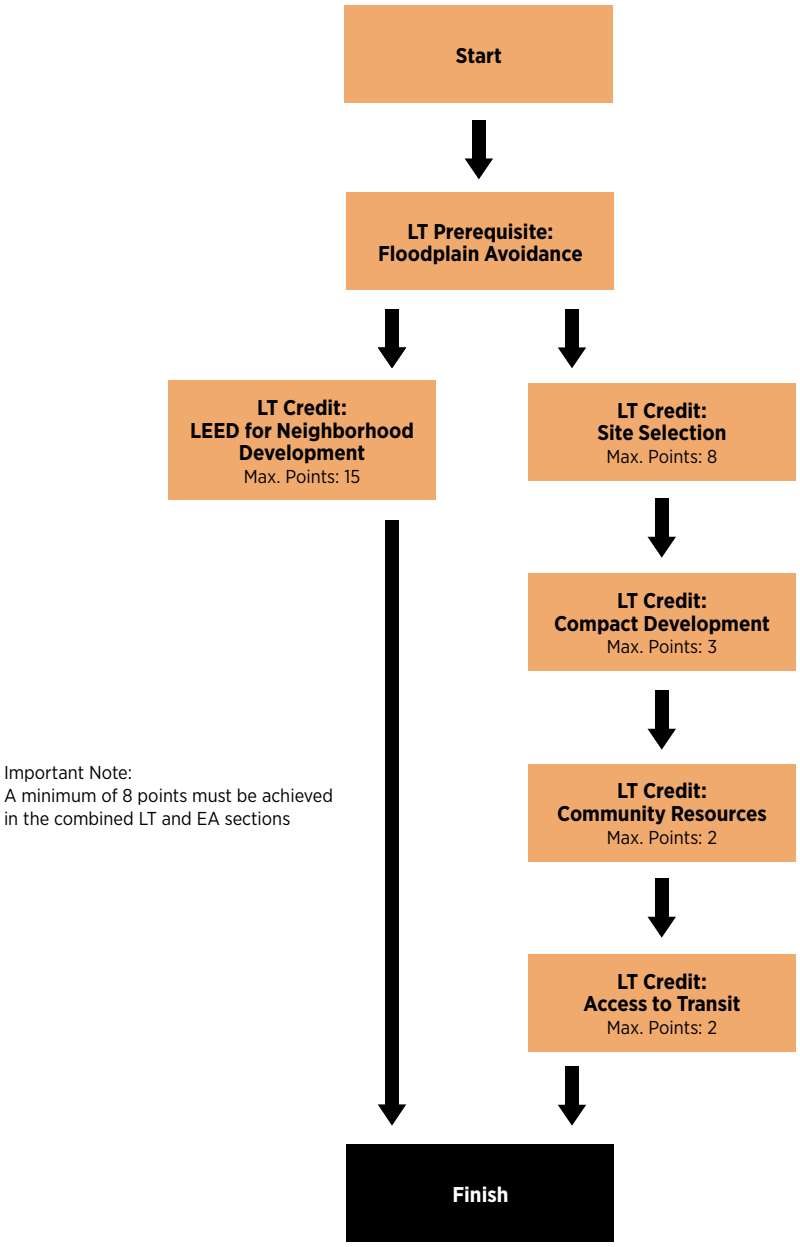
Location and Transportation (LT)

OVERVIEW

Building projects have substantial site-related environmental effects. Location and Transportation (LT) credits reward the choice of site locations that promote environmentally responsible land-use patterns and neighborhoods and offer environmental advantages over conventional developments. (The next credit category, Sustainable Sites, focuses on consequences for the site itself.)

Project teams can reduce fragmentation of farmland and forest and other natural areas by building within and near already-developed areas. Well-sited developments need less infrastructure, especially roads and water and sewer lines. And such developments allow residents to use a range of sustainable transportation options, including walking, bicycling, and mass transit, thereby reducing dependence on personal automobiles.

LT points can be earned in either of two ways, summarized in Figure 1.



Optional Pathways through the LT Category

Sustainable Sites (ss)

OVERVIEW

Although the focus of green building is typically on the built structures, the design of the site and its natural elements can have significant environmental consequences, good or bad. The Sustainable Sites (SS) category rewards project teams for designing the site to minimize adverse effects. (The Location and Transportation category rewards project teams for choosing a preferable site location.)

How a building is incorporated into the site can benefit or harm local and regional ecosystems and reduce or increase demand for water, chemicals, and pesticides for site management. Good decisions, made early in the design process, can result in attractive, easy-to-maintain landscaping that protects native plant and animal species and contributes to the health of local and regional habitats.

Rain that falls on a site can cause soil erosion and runoff of chemicals and pesticides—or it can offset potable water demand and recharge underground aquifers. Plant growth can be a burden, requiring regular upkeep, watering, and chemicals—or it can enhance property values while improving occupants' comfort, absorbing carbon, enriching the soil, and providing shade, aesthetic value, and habitat for native species.

Site design should take into consideration not only the aesthetic and functional preferences of the occupants but also long-term management needs, preservation principles, and potential effects on local and regional ecosystems.

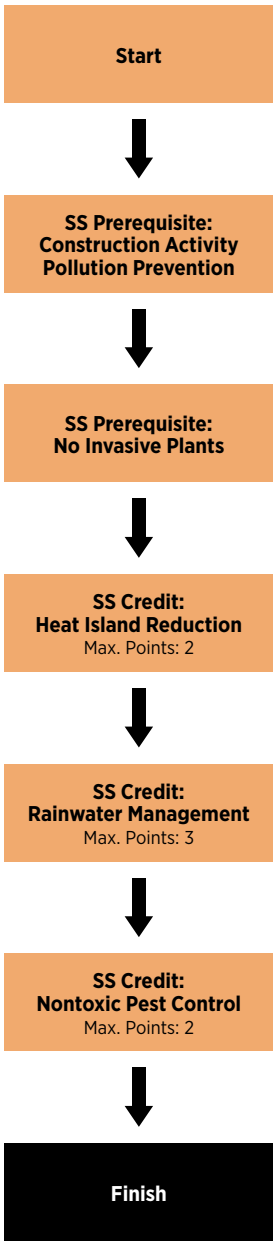


Figure 1. Pathway through the SS category

Water Efficiency (WE)

OVERVIEW

In the U.S., approximately 345 billion gallons of fresh water is withdrawn per day from rivers and reservoirs to support residential, commercial, industrial, agricultural, and recreational activities. This accounts for about one-fourth of the nation's total supply of renewable fresh water. Almost 65 percent of this water is discharged to rivers, streams, and other waterbodies after use and, in some cases, treatment. Additionally, water is withdrawn from underground aquifers. In some parts of the country, water levels in these aquifers have dropped more than 100 feet since the 1940s.

On an annual basis, the U.S. water deficit is currently estimated at 3.7 trillion gallons—that is, each year, Americans extract 3.7 trillion gallons more than they return to the natural water system to recharge aquifers and other water sources.

Water for domestic use may be delivered from a public supplier or be self-supplied (i.e., by a well). Self-supplied domestic withdrawals are an estimated 3.59 billion gallons per day.[1]

The Energy Policy Act of 1992 mandated the use of water-conserving plumbing fixtures and fittings to reduce water use in residential, commercial, and institutional buildings. Water efficiency measures in new homes can easily reduce water usage by 30% or more. In a typical home, savings of 30,000 gallons of water a year can be achieved very cost-effectively. This results in average annual water utility savings of about $100 per year.

As communities grow, increased demand for water necessitates additional maintenance and higher costs for municipal supply and treatment facilities. New homes that use water efficiently have lower water bills and reduced sewage volumes. Many water conservation strategies involve either no additional cost or short-term paybacks; other strategies, such as rainwater harvesting and graywater plumbing systems, often involve more substantial investment.

Figure 1 shows the two pathways for the Water Efficiency (WE) category in the LEED BD+C: Homes and LEED BD+C: Multifamily Midrise rating systems. In one pathway, project teams analyze total water use, both indoors and outdoors. The other pathway awards points based on indoor water use and outdoor water use separately.

1. *U.S. Geological Survey, Estimated Use of Water in the United States in 2000, pubs.usgs.gov/circ/2004/circ1268/*

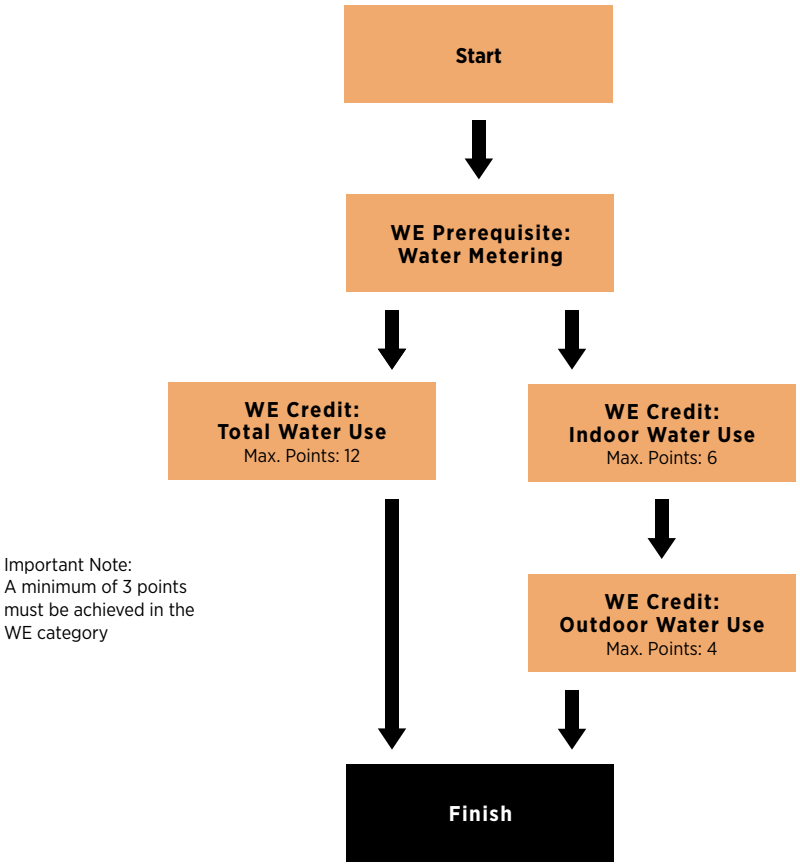


Figure 1. Optional Pathways through the WE Category

Energy and Atmosphere (EA)

OVERVIEW

Although new homes use 14% less energy per square foot than homes built in the 1980s, and 40% less energy per square foot than homes built in the 1950s, according to the U.S. Department of Energy, these efficiency improvements have not kept up the increased size of new homes. The average size of new homes has doubled over the past 50 years. As a result, total U.S. fossil fuel use in homes has been steadily increasing. The average American consumes five times more energy than the average global citizen, 10 times more than the average Chinese person, and nearly 20 times more than the average Indian.[1]

Conventional fossil-based generation of electricity releases carbon dioxide (CO^2), which contributes to global climate change. Coal-fired electric utilities emit almost one-third of the country's anthropogenic nitrogen oxides, the precursor of smog, and two-thirds the sulfur dioxide, which causes acid rain. They also emit more fine particulate material than any other activity in the U.S. Because the human body is incapable of clearing fine particles from the lungs, these emissions are contributing factors in tens of thousands of cancer and respiratory illness–related deaths annually. Natural gas, nuclear fission, and hydroelectric generators all have adverse environmental consequences as well. Natural gas is a major source of nitrogen oxides and greenhouse gas emissions. Nuclear power carries the risk of catastrophic accidents and raises significant waste transportation and disposal issues. Hydroelectric generating plants disrupt natural water flows, disturbing aquatic habitat and reducing fish populations.

Buildings consume approximately 41% of the energy and 74% of the electricity produced in the U.S. annually, according to the U.S. Department of Energy. In 2010, total emissions from residential buildings were responsible for 1.2 billion metric tons of CO^2 emissions, or 22% of the U.S. total.

Scientists predict that left unchecked, emissions of CO^2 and other greenhouse gases from human activities will raise global temperatures by 2.5° to 11.5°F (1.4° to 6.4°C) this century. The effects will be profound and may include rising sea levels, more frequent floods and droughts, and increased spread of infectious diseases. To address the threat of climate change, greenhouse gas emissions must be reduced. Meeting the challenge will require dramatic advances in technologies and a shift in how the world economy generates and uses energy.

Absent significant improvements in environmental performance, the residential building sector will be a major contributor of global CO^2 emissions. Homes have a lifespan of 50 to 100 years, during which they continually

1. *Making Better Energy Choices, Worldwatch, worldwatch.org/node/808#1.*

consume energy and produce CO^2 emissions. Further, the U.S. population and economy are projected to grow significantly over the coming decades, increasing the need for new homes. To meet this demand, approximately 1.5 million new homes a year will be constructed by 2016.

Building green homes is one of the best strategies for meeting the challenge of climate change because the technology to reduce energy and CO^2 emissions already exists. The average certified LEED home uses 30% to 40% less electricity and saves more than 100 metric tons of CO^2 emissions over its lifetime. Modest investments in energy-saving and other climate-friendly technologies can make homes and communities more healthful, comfortable, durable, energy-efficient, and environmentally responsible places to live.

The average mix of end uses of energy in U.S. homes is summarized in Figure 1.

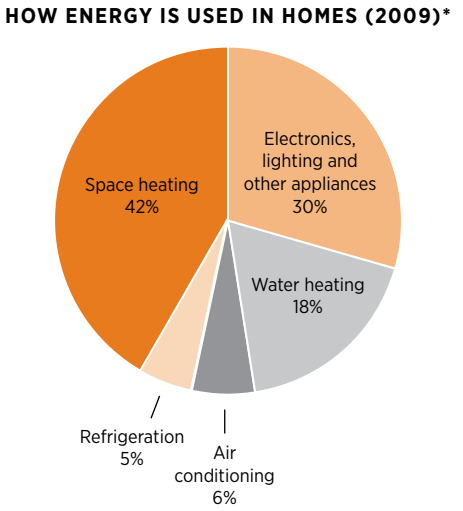


Figure 1. Energy use in U.S. homes. Modified from U.S. Energy Information Administration, Residential Consumption Survey (RECS) 2009.

The actual percentages vary with climate and location—homes in the North use proportionally more energy for space heating and less for electric air-conditioning than homes in the South, and vice versa—but these uses nevertheless represent the primary target areas for energy efficiency improvements.

Figure 2 shows the two parallel pathways through the Energy and Atmosphere (EA) credit category in the LEED BD+C: Homes and LEED BD+C: Multifamily Midrise rating systems. The performance pathway requires the use of an approved energy analysis software program to demonstrate the overall energy performance of the home's design. The prescriptive pathway enables a project to achieve LEED points without energy modeling. The project may instead demonstrate that each of the prescriptive requirements has been achieved. Credits can be earned using either approach, but projects are encouraged to use the performance pathway.

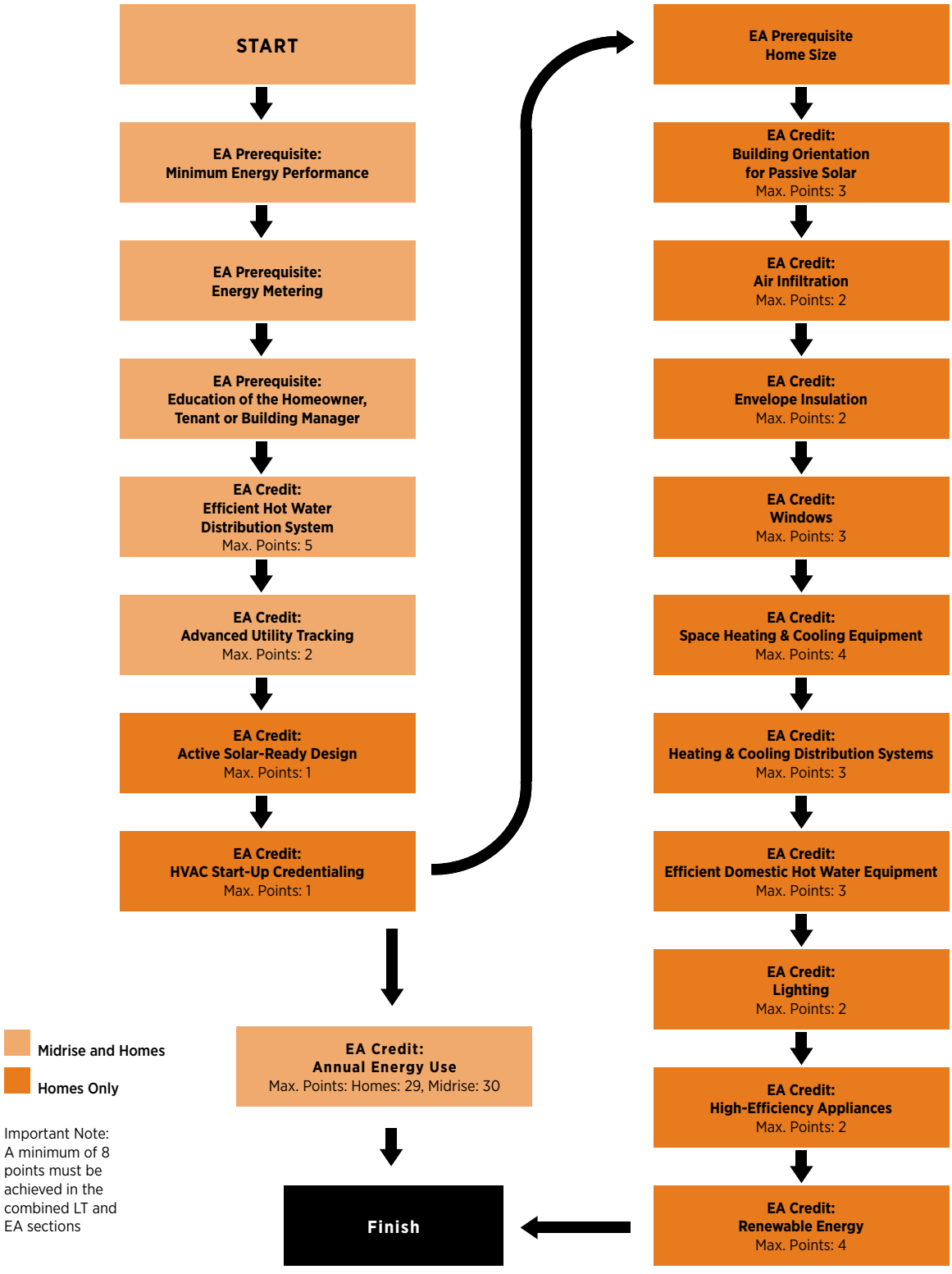
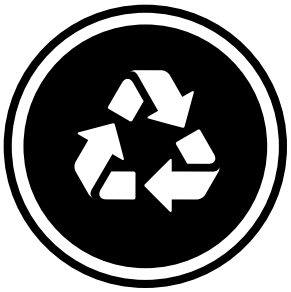


Figure 2. Optional Pathways through the EA Category



Materials and Resources (MR)

OVERVIEW

The choice of building materials is important for sustainable homebuilding because of the extraction, processing, and transportation they require. Activities to produce building materials may pollute air and water, destroy natural habitats, and deplete natural resources. Construction and demolition wastes constitute about 40% of the total solid waste stream in the U.S.

Sources should be evaluated when materials are selected for a project. Reclaimed (i.e., salvaged postconsumer) materials can be substituted for new materials, saving costs and reducing resource use. Recycled-content products make use of material that would otherwise be deposited in landfills. Use of local materials supports the local economy and avoids the harmful effects of long-distance transport. Use of third-party–certified wood promotes good stewardship of forests and related ecosystems.

An increasing number of public and private waste management operations have reduced construction debris volumes by recycling these materials. Recovery activities typically begin at the job site, with separation into different bins or disposal areas. In some areas, regional recycling facilities accept commingled waste and separate the recyclable materials from those that must go to the landfill. These facilities can achieve waste diversion rates of 80% or greater.

One aspect of home design that is often overlooked is the assessment and mitigation of long-term durability risks to the home. Durability failures are a significant cost and cause of stress for both builders and homeowners, but many easy and low-cost strategies are available to builders who consider durability in the up-front design.

Good design decisions, particularly in the structural framing of homes, can significantly reduce demand for lumber and other materials, as well as the associated waste and embedded energy. Without changing the design, a builder can save framing materials and reduce site waste by planning appropriately and communicating the strategies to the framing contractor.

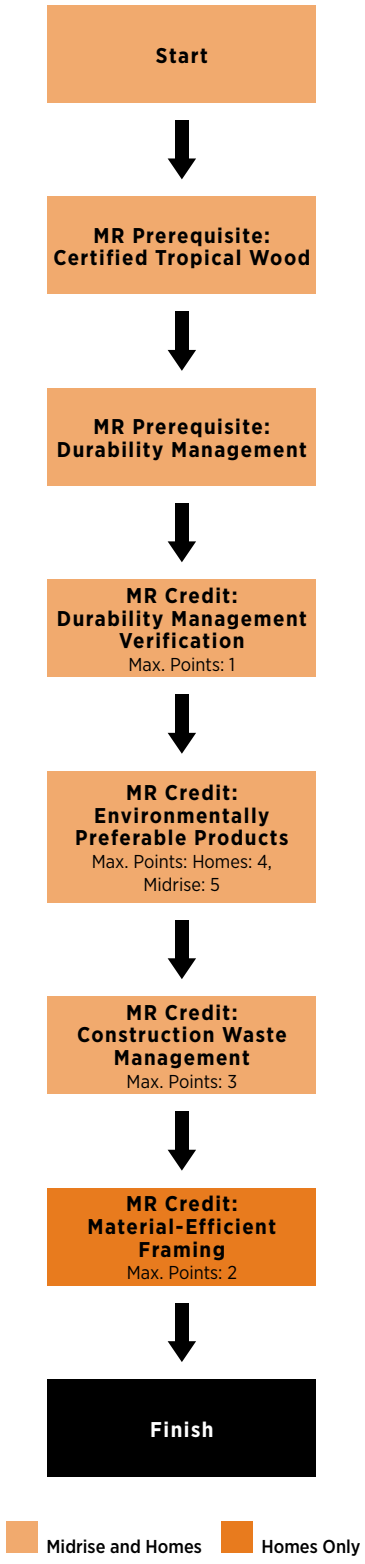


Figure 1. Pathway through the MR category

Indoor Environmental Quality (EQ)

OVERVIEW

Americans spend, on average, 90% of their time indoors, where levels of pollutants may run two to five times—and occasionally more than 100 times—higher than outdoors, according to the U.S. Environmental Protection Agency.[1] Similarly, the World Health Organization[2] reports that most of an individual's exposure to many air pollutants comes through inhalation of indoor air. Many of the pollutants found indoors can cause health reactions in the estimated 17 million Americans who suffer from asthma and 40 million who have allergies, contributing to millions of days absent from school and work.

Homeowners are just beginning to realize the link between their health and their homes. Hazardous household pollutants include carbon monoxide, radon, formaldehyde, mold, dirt and dust, pet dander, and residue from tobacco smoke and candles. Many homeowners also store various chemicals inside their homes, including pesticides, fertilizers, solvents, grease, oils, degreasers, gasoline, antifreeze, strong detergents, thinners, and oil-based paints.

Over the past 20 years, research and experience have improved our understanding of what is involved in attaining high indoor environmental quality and revealed manufacturing and construction practices that can prevent problems from arising. Preventing indoor air quality problems is generally much less expensive than identifying and solving them after they occur. Generally, there are three types of strategies: source removal, source control, and dilution.

Source removal is the most practical way to ensure that harmful chemical compounds are not brought into the home. Evaluating the properties of adhesives, paints, carpets, composite wood products, and furniture and selecting materials with low levels of potentially irritating off-gassing can reduce occupants' exposure. Thoughtful scheduling of deliveries and sequencing of construction activities can reduce exposure of materials to moisture and absorption of off-gassed contaminants.

Source control strategies focus on capturing pollutants that are known to exist in a home. For example, filtering the supply air stream removes particulates that would otherwise be continuously recirculated through the home. Protection of air-handling systems during construction and performing a building flushout before occupancy further reduce the potential for problems.

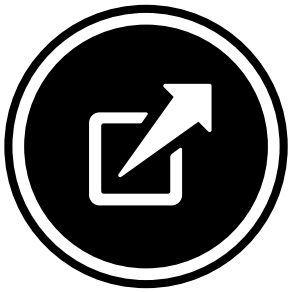
1. *U.S. Environmental Protection Agency. 2001. Healthy Buildings, Healthy People: A Vision for the 21st Century. epa.gov/iaq/hbhp/hbhptoc.html.*
2. *World Health Organization. 2000. Air Quality Guidelines for Europe, 2nd edition. euro.who. int/document/e71922.pdf.*

Dilution involves the use of fresh outside air to ventilate a home and exhaust pollutants to the outdoors. This may also help control moisture within the home. Most new homes in the U.S. do not have mechanical fresh-air ventilation systems. The typical air-handling systems in new homes merely recirculate the air within the home, continuously pumping indoor pollutants through the rooms rather than exhausting them.

Another aspect of indoor air quality is occupants' comfort. The proper installation of automatic sensors and controls to maintain proper temperature, humidity, and ventilation in occupied spaces helps maintain optimal air quality. Surprisingly, sensors to alert a home's occupants to deadly carbon monoxide concentrations are frequently not required by code but should be included in all new homes. Letting occupants fully and effectively control their thermal environment can reduce hot-cold complaint calls and generally raise satisfaction levels.

The Indoor Environmental Quality (EQ) credit category encourages builders to prevent air pollution and improve air quality and comfort in the homes they build.

Figure 1. Pathway through the EQ category



Innovation (IN)

OVERVIEW

Sustainable design strategies and measures are constantly evolving and improving. New technologies are continually introduced to the marketplace, and up-to-date scientific research influences building design strategies. Occasionally, a strategy results in building performance that greatly exceeds that 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.

Green homebuilding strategies and techniques are most effectively implemented as part of an integrated design process, with input from individuals involved in each phase of the project. Good design can keep costs down and ensure proper integration of green techniques and achievement of project goals.

The Innovation (IN) credit category encourages project planning and design to improve the coordination and integration of the various elements in a green home. This category also creates an opportunity for projects to earn credit for implementing strategies or measures not addressed in the current LEED BD+C: Homes or LEED BD+C: Multifamily Midrise rating systems. Points can be earned for innovative strategies, exemplary performance, or regional best practices that deliver quantifiable environmental and human health benefits.

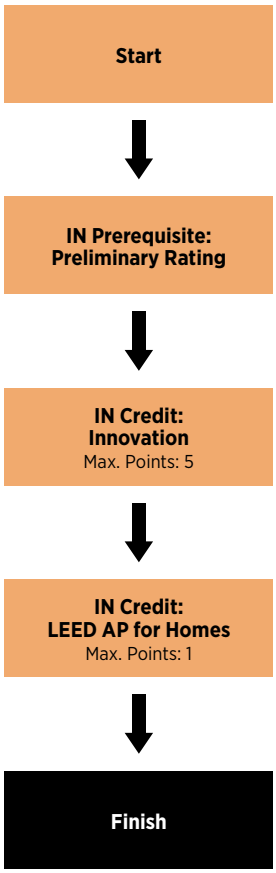


Figure 1. Pathway through the IN category

Regional Priority (RP)

OVERVIEW

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

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

Because each LEED project type (e.g., a data center) may be associated with different environmental impacts, each rating system has its own RP credits.

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

APPENDIX:
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

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**
Hot food holding cabinets (excluding drawer warmers and heated display) 28 $ft^3 \leq V$	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
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

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 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
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

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, 0 < V < 15 ft³	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.118V + 1.382 kWh/day	na
Glass-door reach-in refrigerator, 15 ≤ V < 30 ft³	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.140V + 1.050 kWh/day	na
Glass-door reach-in refrigerator, 30 ≤ V < 50 ft³	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.088V + 2.625 kWh/day	na
Glass-door reach-in refrigerator, 50 ≤ V ft³	Elec	Refrig	0.12V + 3.34 kWh/day	na	≤ 0.110V + 1.500 kWh/day	na
Solid-door reach-in freezer, 0 < V < 15 ft³	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.250V + 1.25 kWh/day	na
Solid-door reach-in freezer, 15 ≤ V < 30 ft³	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.400V – 1.000 kWh/day	na
Solid-door reach-in freezer, 30 ≤ V < 50 ft³	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.163V + 6.125 kWh/day	na
Solid-door reach-in freezer, 50 ≤ V ft³	Elec	Refrig	0.4V + 1.38 kWh/day	na	≤ 0.158V + 6.333 kWh/day	na
Solid-door reach-in refrigerator, 0 < V < 15 ft³	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.089V + 1.411 kWh/day	na
Solid-door reach-in refrigerator, 15 ≤ V < 30 ft³	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.037V + 2.200 kWh/day	na
Solid-door reach-in refrigerator, 30 ≤ V < 50 ft³	Elec	Refrig	0.1V + 2.04 kWh/day	na	≤ 0.056V + 1.635 kWh/day	na
Solid-door reach-in refrigerator, 50 ≤ V ft³	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

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**
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

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**
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
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

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**
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
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

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, 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
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

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**
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
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