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Professional Engineer's Guide to the ENERGY STAR® Label for Buildings

Outline

Introduction

Since January 1999, the U.S. Environmental Protection Agency (EPA), in coordination with the U.S. Department of Energy (DOE), has given the public the means to quickly and easily assess – or benchmark – the energy performance of commercial buildings relative to their peers. After normalizing for the most significant drivers of energy intensity (such as weather and building characteristics), buildings whose performance is among the nation's top 25 percent (equal to a score of 75 or greater on an established 1 to 100 scale) and that maintain a healthy and productive indoor environment can qualify for the ENERGY STAR® label for buildings.

Portfolio Manager is an on-line, interactive, software tool that makes benchmarking energy performance simple and accessible. To assess building energy performance, users enter information about a building's physical characteristics, operating characteristics, and energy consumption. When they have finished, users are given the following information: 1) a benchmarking score on a 1 to 100 scale; 2) weather-normalized energy intensity; and 3) a customized performance target, equivalent to a score of 75, which takes into account the building's specific physical and operating characteristics.

After the building's energy performance is assessed, users can apply for the ENERGY STAR label by completing an application letter and an official Statement of Energy Performance. See Appendix A for an example copy of a completed Statement of Energy Performance. The Statement of Energy Performance is a stand-alone document designed to communicate not only a building's energy performance, but also its physical characteristics, operating characteristics, and conformance to current indoor environmental standards. Once validated by a professional engineer (PE), the Statement of Energy Performance becomes an official document that can be used to apply for the ENERGY STAR label for buildings. Whether the user wants to apply for the ENERGY STAR label or only wants to complete a Statement of Energy Performance, the role of the PE is essential to the credibility of the outcome.

PEs provide unbiased engineering services and are legally bound to uphold standards of ethics. Because of this high level of professionalism, experience, and expertise, a PE is required to validate each Statement of Energy Performance for it to be considered "official" whether it is used to apply for the ENERGY STAR label or for any other purpose. Services performed by PEs in connection with the ENERGY STAR Label program shall in no way be construed to diminish or otherwise modify the responsibilities or liability of the original designer or operator of the building.

Validating a Statement of Energy Performance requires the PE to review two categories of user-provided information:

- The PE must verify that the data entered about the building are accurate. This includes verifying the values entered for its physical characteristics, operating characteristics, and energy consumption.
- The PE must visit the building and verify that it conforms to current industry standards for indoor environment. These standards cover temperature and humidity, illumination, outside air ventilation, and control of indoor air pollutants.

This document, the *Professional Engineer's Guide to the ENERGY STAR® Label for Buildings*, intends to help the PE community better understand the requirements of the Statement of Energy Performance and the expectations and limitations of their role. This document is structured in modules. Each module covers a single topic and contains a purpose, background, expectations, hints and tips, and questions and answers. Where needed, industry standards are referenced and detailed tables are given. EPA is committed to continually improving the content of this document, and welcomes all comments that may help us do so.

EPA thanks you for choosing to take part in this process. We hope you find this experience professionally rewarding and are able to forge new or expand existing business relationships. In so doing, you can be assured that you are helping to mitigate society's impact on the environment and climate change.

Physical Characteristics

Purpose

To verify the recorded physical characteristics of a building that is being evaluated for a Statement of Energy Performance and/or the ENERGY STAR label.

Background

To assess the performance of a building by using Portfolio Manager, the physical characteristics entered by the user must be accurate. Physical characteristics include building floor area in square feet (ft^2) (or square meters (m^2) for eligible buildings outside the United States), building name, street address, and year of primary construction.

Expectations of the PE

The PE is expected to verify the accuracy of the recorded physical characteristics.

Requirements

The information needed to complete a Statement of Energy Performance and/or to apply for the ENERGY STAR label varies by building type and is given below. Currently there are five eligible building space types: offices, K-12 schools, grocery stores/supermarkets, hotel/motels, and acute care/children's hospitals.

All Buildings

- Gross floor area must be at least 5,000 ft^2 (490 m^2). Exception: convenience stores must be at least 1,000 ft^2 (98 m^2).
- The building must be located within the United States of America or its territories. Buildings owned by the United States government that are located in foreign lands are also eligible at this time.
- A 5-digit ZIP code must be recorded for buildings located in the USA or its territories. For buildings owned by the United States government that are located in foreign lands, the location most closely relating to the building in terms of climate must be indicated. Typically, this is the location nearest that of the building. Choices of location are by major city that has an international airport. In some cases there may be only one location for an entire country.
- The presence of an attached parking structure on the same utility meter(s) must be recorded.

K-12 Schools

- The presence of a swimming pool on the same utility meter as the remainder of the school must be recorded.

Hotel/Motels

- Limited to only Upper Upscale, Upscale, Midscale with Food and Beverage, Midscale without Food and Beverage, and Economy & Budget. Specifically excluded are Resort and Extended Stay hotels. See Appendix B for definitions and examples of each eligible hotel/motel type.
- The average annual room occupancy must be at least 50 percent.

Hospitals

- This is limited to only Acute Care and Children's Hospitals. Specifically excluded are all hospitals primarily used as out-patient facilities, cancer centers, skilled nursing centers, psychiatric care hospitals, rehabilitation centers, or veterinary clinics. See Appendix B for definitions.

Hints & Tips

Original specifications, design documents, and "as-built" drawings can be used to confirm certain physical characteristics. However, because the actual physical characteristics of the building can vary significantly from these plans and records, any review of documentation should always be combined with a physical inspection of the building.

Physical Characteristics Q&A

Are buildings that are owned by U.S. based companies or by the Federal Government but that are located outside of the United States eligible to apply for the ENERGY STAR label?

Buildings located on foreign lands but owned by U.S.-based companies are not currently eligible to apply for the ENERGY STAR label. However, buildings that are located on foreign lands but that are owned and occupied by the United States government and that meet U.S. construction codes are eligible to apply for the ENERGY STAR label.

Is the PE expected to physically count each required input such as occupants, PCs, or rooms to verify the quantity in a given space?

No. The PE may verify this information by asking credible parties who have a detailed knowledge of the building. However, it is good practice to verify in person any doubtful information.

Are common areas to be included when determining the floor area of the building or a given space (for example, office space)?

Yes, the user-entered value for area must be the gross interior area of the building, or in the case of a user-specified office block, the gross interior area of the office block. This includes all area enclosed by the exterior walls of the building, including hallways, lobbies, stairways, elevator shafts, and electrical/mechanical/janitorial closets.

Should the floor area of a parking garage or surface parking be entered into Portfolio Manager?

Yes, if the energy consumption for a parking garage or surface parking is included in the utility data. Portfolio Manager will compensate for the energy use of the garage based on the floor area, but will report the gross floor area of the building less the floor area of the garage or parking lot.

Can parking garage or surface parking be excluded from the analysis?

Yes, if the energy consumption of the garage or surface parking is separately metered and is not included in the utility bill data provided in Portfolio Manager.

How is the area (that is, square footage) and energy use for an unattached parking garage treated when the electricity and/or fossil fuels are NOT separately metered?

Unattached garage space on the same meter is treated as if the structure were physically attached to the primary building and is subject to the eligibility requirements for the ENERGY STAR label.

Operating Characteristics

Purpose

To verify the recorded operating characteristics of a building that is being evaluated for a Statement of Energy Performance and/or the ENERGY STAR label.

Background

To assess the performance of a building by using Portfolio Manager, building operating characteristics entered by the user must be accurate. Operating characteristics include the space type designation, and rates of occupancy and vacancy.

For each building type, Portfolio Manager uses operating characteristics to perform two important functions. First, the information is used to determine the eligibility of a building to have its performance assessed. Second, the information is used to generate a performance target – a level of energy performance at and above which is consistent with ENERGY STAR – customized for the building.

Expectations of the PE

The PE is expected to verify:

- That the building meets the eligibility requirements for the ENERGY STAR label.
- The accuracy of the operating characteristics.

Eligibility Requirements

Eligibility requirements must be met when completing a Statement of Energy Performance and/or when applying for the ENERGY STAR label. The following requirements vary by building type and are effective as of November 1, 2001.

All buildings must have:

- Been occupied at least 11 of the most recent 12 months. Exception: K-12 schools must have been occupied at least 9 of the most recent 12 months.
- Been in use at least 35 hours per week throughout the period of occupancy.
- An average annual vacancy rate of not more than 20 percent.
- At least 50 percent of the gross building square footage designated as any combination of office, K-12 school, grocery stores/supermarkets, hotel/motels, and acute care/children's hospitals.
- No more than 10 percent of gross square footage designated as computer room/data center.

Operating Characteristics

The following operating characteristics must be verified:

Office buildings

- Average weekly occupancy hours
- Number of workers
- Number of personal computers (PCs)

K-12 schools

- Average weekly occupancy hours
- Number of students

- Percentage of gross floor area that is mechanically cooled
- Presence of cooking facilities in operation

Grocery stores/supermarkets

- Average weekly operating hours
- Number of workers during main shift, on average
- Number of electronic registers and personal computers
- Number of refrigeration cases, both open and closed type
- Number of walk-in refrigeration units, both freezers and refrigerators
- Presence of cooking facilities in operation

Hotel/Motels

- Number of occupiable rooms
- Presence of cooking facilities in operation
- Percentage of available rooms occupied corresponding to the period of the energy data
- Presence of on-site laundry facilities used for washing and drying all daily in-room linens such as towels and sheets

Acute Care/Children's Hospitals

- Number of beds
- Maximum number of floors

Hints & Tips

For **office buildings**, it can be useful to contact the building's local area network (LAN) manager or the equivalent to find out the average number of workers and number of PCs throughout the year, and the typical weekly operating hours.

For **K-12 schools**, the administrative office typically has information on the number of students, average weekly occupancy hours, whether cooking facilities are present and in use, and the extent and use of air-conditioning.

For **grocery stores/supermarkets**, the average number of refrigeration cases and the relationship between linear feet of refrigeration cases and average number of cases can be useful in determining the on-site conditions. Typical refrigeration cases, whether open or closed, come in three standard sizes: 4-feet, 8-feet, and 12-feet. On average, grocery stores/supermarkets contain 6.4 open refrigeration cases per 10,000 ft^2 and 5.3 closed refrigeration cases per 10,000 ft^2. To receive a valid benchmarking score and be eligible to apply for the ENERGY STAR label, the total number of refrigeration cases present must be verified. The values provided above are intended as references only and should *not* be used to calculate values for entry within Portfolio Manager.

Because HVAC systems are often scheduled to operate for a period of time before and after the typical period of occupancy, using data from an EMCS can substantially overstate the weekly operating hours as defined in Portfolio Manager.

Operating Characteristics Q&A

Are the weekly operating hours the same as the hours that the HVAC system is operating, including start-up and shut-down periods?

No. Weekly operating hours are defined as the number of hours per week in which the majority of the primary tenants (workers for office buildings, customers for grocery stores/supermarkets, and students for K-12 schools) are within the confines of the building. Note: Typically the operating hours of hotel/motels and hospitals are 168 hours per week.

Does an employee kitchen or galley count as a cooking facility?

No. In Portfolio Manager this question is used to determine whether it contains a cooking facility, such as a cafeteria, where food is prepared and served to the primary occupants, customers, or guests. Employee kitchens and galleys are outside the intent of this question. Cafeterias that serve only to keep food warm that was prepared elsewhere should not be considered cooking facilities.

How should office buildings that have a large (for example, one half of one full floor), full-service cafeteria within the main office building structure be handled? Is this space considered part of the primary office space or is it considered another space type, such as restaurant?

If all energy sources used by the cafeteria space are sub-metered, then its energy impact and associated square footage can be removed from the analysis within Portfolio Manager. If any energy source used by the cafeteria is not sub-metered, then the space should be considered part of the building's office space.

Energy Consumption

Purpose

To verify the recorded energy consumption for each type of fuel used within a building that is being evaluated for a Statement of Energy Performance and/or the ENERGY STAR label.

Standard

Not applicable.

Background

To assess the performance of a building by using Portfolio Manager, all sources of energy within the building must be entered. Currently, the following fuel sources are acceptable: electricity, natural gas, fuel oil, diesel fuel, district steam or hot water, district chilled water, propane, liquid propane, and wood.

On-site electric production and on-site renewable energy should be treated from the perspective of the curb. That is, only energy that crosses the curb and enters the building should be included. On-site generation of electricity typically consumes either natural gas or diesel fuel. In this case, include the consumption of natural gas or diesel fuel, but do NOT include the amount of electricity generated on-site. As long as the generation of on-site electricity is more efficient than that of the power grid (typically 33 percent), credit is effectively given and the resulting benchmark score will be higher. Renewable energy generated on-site would not be included because no energy flows across the curb. Effectively, renewable energy acts to offset the consumption of energy that would otherwise cross the curb.

Buildings or facilities that distribute energy produced on-site to other buildings should remove the impact of this additional energy use. To accomplish this, a meter should be included in the Portfolio Manger record having negative monthly values for each fuel type that is leaving the building for consumption off-site at another location.

Verification of Energy Consumption

Verification of building energy consumption requires all of the following to be true:

- Monthly consumption for all energy sources used within the building have been accounted for and are accurate.
- At least 10 monthly energy-consumption entries spanning a period of 365 days +/- 45 days for each source of energy in the building are present (* - see note below).
- Each monthly entry has contiguous start and end dates.

*The consumption of fuel oil and diesel fuel often is recorded as annual or semi-annual deliveries. Portfolio Manager can accommodate fewer than 10 entries for fuel oil and diesel fuel only.

Expectations of the PE

The PE is expected to review energy consumption documentation for each energy source used in the building to validate the energy consumption values entered in Portfolio Manager. Included in the documentation are the following:

- Monthly energy consumption for each energy source spanning the most recent 12 months.
- Consumption, or monthly billing, dates for each entry.

Electrical demand (kW) and energy-cost information for the most recent 12 months as recorded by the user in Portfolio Manager also should be verified.

Hints & Tips

First, review actual monthly energy bills provided by the management or owners. Other sources of energy consumption data, such as spreadsheet tracking and Energy Management Control System (EMCS) output, might be incomplete or not record all fuels or meters within the building.

Before reviewing the building record in Portfolio Manager or performing the building walk-through you should do the following:

- Get copies of actual energy bills and any record of monthly EMCS output.
- Determine the number of energy sources used within the building.
- Ask about the energy sources for any equipment that uses something other than electricity (for example, domestic water heaters and back-up electrical generators).

Energy Consumption Q&A

To verify the monthly energy consumption, must monthly bills from the utility company be independently obtained?

No. If the PE is confident based on his/her walk-through that all of the energy sources and meters are accounted for, then independently obtained monthly utility bills are not required. In all but the rarest of cases, the review of existing monthly energy bills that have been provided by the building management or owner is sufficient.

Are monthly utility bills needed to verify the monthly energy consumption of each fuel?

No. If, based upon the judgment of the PE, a building-wide, energy-tracking tool, such as an EMCS, is in use and fully tracks consumption of any fuel, it can be used instead of utility bills.

Are simulated or calculated values for monthly energy consumption acceptable?

No. Other than the exception outlined below, simulated or calculated values for monthly energy consumption are not acceptable to complete a Statement of Energy Performance and/or to apply for the ENERGY STAR label. Exception: for fuel oil and diesel fuel only, an estimate of monthly consumption *based on actual annual receipts* is permissible provided that there are at least six data entries (entries of "0" are acceptable).

Should the electrical outputs of on-site renewable sources or co-generation units be included as part of the building's monthly energy consumption?

No. Full credit is given for the use of on-site renewables. The energy input required by the co-generation unit must be accounted for in Portfolio Manager, but not the electricity that is generated.

How should the square footage and energy use for a parking garage be handled for which the electricity and/or fossil fuels are not separately metered?

Portfolio Manager is able to handle both open parking lots and parking garages. Portfolio Manager incorporates an equitable energy impact into the target consumption values corresponding to benchmarking scores from 1 to 100.

What if the facility sells or distributes energy to other buildings (that is, the benchmarked building makes and distributes hot water, steam, chilled water, or electricity to adjacent buildings)?

Portfolio Manager is able to account for energy consumed by the building and distributed to other entities. This is accomplished by creating a meter with negative values for each fuel type that is leaving the building for consumption off-site.

Thermal Comfort

Purpose

To determine if the interior occupied spaces of the building are meeting current industry standards for temperature and humidity.

Standard

ASHRAE Standard 55-1992, Thermal Environmental Conditions for Human Occupancy.

Background

According to ASHRAE Standard 55, acceptable thermal environment of indoor spaces designed for human occupancy is dependent upon operating temperature and relative humidity. The effectiveness of the building in providing the specified thermal environmental conditions is dependent upon the outdoor air temperatures, simplified here as heating (for example, in winter) and cooling (for example, in summer) modes.

Acceptable Thermal Environmental Conditions

The acceptable thermal environmental conditions, dry-bulb temperature and relative humidity, during both heating and cooling modes are as follows:

	Heating Mode	Cooling Mode
Dry-Bulb Temperature Range:	68° F to 74°F	73° F to 79° F
Relative Humidity Range:	30% to 60%	30% to 60%

Expectations of the PE

The PE is expected to give a professional opinion about the capability of the building to provide acceptable thermal environment conditions per ASHRAE Standard 55. The PE should measure the temperature and humidity of a representative sample of the occupied interior spaces of the building during occupied hours. It is the responsibility of the PE to consider all measured data and observations at the time of the site visit and to determine, in his/her professional opinion, whether the building meets the letter and spirit of ASHRAE Standard 55.

Hints & Tips

Reviewing previous indoor air quality reports or testing, adjusting, and balancing (TAB) reports is generally *not* acceptable as a sole source of information when giving a professional opinion about whether the building can provide acceptable thermal environmental conditions.

It is highly recommended that the PE, as part of the evaluation of the occupied spaces, observe and record such signs of possible occupant thermal discomfort as:

- Oscillating table fans, window fans, or other personal fans
- Personal space heaters
- Open windows
- Window or through-the-wall style room air-conditioners
- Covered or otherwise occupant-modified supply air diffusers
- Altered or broken thermostats

Take temperature and humidity measurements in occupied areas that have the highest concentration of the items listed above. This is a good way to check the most problematic occupied areas in the building.

Thermal Comfort Q&A

Must the building be assessed as it operates in both heating and cooling modes?

No. The capability of the building to meet ASHRAE Standard 55, for the purposes of the Statement of Energy Performance, should be determined based on the mode of the HVAC system at the time of the assessment. However, the presence and prevalence of personal comfort items noted above should always factor into the decision of the PE whether or not they are operating.

Are temperature and humidity measurements required for every occupied space within the building?

No. The PE should take a representative sampling of the occupied spaces. Several factors might influence a PE's decision or require further measurement. For example, if many of the spaces measured are barely meeting the temperature and humidity conditions, then more measurements may be needed. Similarly, if there are a significant number of personal comfort devices (for example, fans, heaters and window a/c units) or damaged and/or occupant-altered HVAC equipment (for example, diffusers and thermostats), the PE should consider additional measurements in these areas.

If the measured temperature and/or humidity of a single occupied space are outside the acceptable thermal conditions listed in ASHRAE Standard 55, is that in and of itself grounds to "fail" for the thermal comfort?

Generally no. The assessment of thermal comfort should take into account all measurements and observations, and does not depend upon one occupied space not meeting the temperature and humidity requirements. After considering all measured data and observations, it is the responsibility of the PE to determine whether the building meets the letter and spirit of ASHRAE Standard 55.

Why are TAB reports and Indoor Air Quality (IAQ) assessments generally not acceptable to assess whether acceptable thermal environmental conditions are being met?

There are two reasons: 1) the assessment is intended to be a professional opinion at the time of the site visit; and 2) the assessment is intended to be based on the measurements and observations of the PE hired to perform the assessment. TAB reports and IAQ assessments can be useful for the PE to review because they may give confirmation of the PE's measurements and observations as well as indicate problem areas that need further assessment or measurement.

Illumination

Purpose

To determine if the interior occupied spaces of the building, and the generally unoccupied exterior spaces (for example, parking garages and parking lots) associated with the building are maintaining current industry standards for illumination.

Standard

Illuminance Selection Procedure, IESNA Lighting Handbook: Reference & Application, 9th Edition.

Background

According to the Illuminance Selection Procedure, IESNA Lighting Handbook, illuminance levels for specific applications are recommended based on the Society's judgment of best practice for a "typical" application. While illuminance is not the sole, or in many cases the most important lighting design criteria, it is a useful indicator to determine if the lighting system performance has been compromised in pursuit of energy conservation.

Acceptable Illumination Levels

The IESNA Lighting Handbook recommends horizontal and/or vertical task illuminances for a wide variety of locations and tasks. Deviation from the recommended illumination levels of roughly 20% is acceptable, given that the lighting design is frequently tailored to the specific occupant needs and task characteristics for that space (for example, task contrast and size, background reflectance, occupant age, etc.). The IESNA considers deviations from the recommended illumination levels of 33% to be dramatic. While a survey of actual task illuminances will undoubtedly reveal areas that are outside of this range, a number of dramatic deviations should be questioned and challenged against the design illuminance. A sample of the minimum recommended illumination levels in foot-candles (FC) are given in the table below. Please refer to the IESNA Lighting Handbook for a full listing of recommended illumination levels of interior spaces.

Space Type	Horizontal (FC)	Vertical (FC)
Interiors		
Private Offices	50	5
Open Plan Offices	30 to 50	5
Lobbies/Reception Areas	10	3
Stairways and Corridors	10	–
Restrooms	5	3
Educational Classrooms		
Reading – chalk boards	–	50
Reading – pen/typed print/#2 pencil	30	–
Science Labs	50	30
Health Care Facilities		
Emergency outpatient – general	50	10
Lobby	5	3
Nursing stations		
General	30	5
Desk	50	10
Patient rooms – general	5	3

Stairways	10	3
Utility rooms	30	3
Waiting areas - general	10	3
Toilets	10	3
Hotels		
Guest rooms – general	10	–
Bathrooms	30	5
Corridors, elevators, stairs	5	–
Front desk	50	–
Lobby – general lighting	10	–
Linen room – general	10	–
Supermarkets (shelving)	50	10
Merchandising/retail store spaces		
Stock rooms	30	5
Sales transaction area	30	–
General merchandise display	50	10
Feature display	100	30
Circulation	10	–
Parking Facilities		
Covered Parking Garages		
Basic	1	0.5
Ramps	2 day/1 night	1 day/0.5 night
Entrance Areas	50 day/1 night	25-day/0.5 night
Stairways	2	1
Parking Lots	0.2	0.1

Expectations of the PE

The PE is expected to give a professional opinion about the capability of the building to provide minimum recommended illumination levels of both occupied spaces (that is, interior spaces) and generally unoccupied spaces (that is, parking garages and parking lots) per the Illuminance Selection Procedure in the IESNA Lighting Handbook. In so doing, the PE should measure the illumination levels in a representative sample of the occupied interior spaces of the building as well as any associated parking facilities. It is the responsibility of the PE to decide, based on his/her professional opinion, whether the building meets the minimum recommended illumination levels considering all measured data and observations at the time of the site visit.

Hints & Tips

When measuring illuminance, remember to position the light meter at the proper height on the work surface at the task location (either vertical or horizontal). Avoid shadowing the meter with your body, and avoid reflections off of clothing.

Allow thirty minutes between system switch-on and the first measurement to ensure that the lighting system has reached a stable condition.

Daylight effects should be eliminated by performing the lighting survey after dark, or with the blinds closed and measuring the daylighting contribution with the lights off and subtracting its contribution to the electric lighting.

Illumination should be checked both directly under the fixture, and between fixtures (both laterally and longitudinally).

Uniformity should also be evaluated, particularly next to walls and in corners.

Areas with occupant-supplied task lights, de-lamped fixtures, or numerous burned-out lamps should receive additional scrutiny as areas that may be under lit.

Illumination Q&A

The following questions and answers are intended to provide additional guidance with regard to the building meeting IESNA recommended illumination levels.

If the measured illumination levels of a single occupied space are below the minimum recommended levels as defined in the IESNA Lighting Handbook, is that, in and of itself, sufficient grounds to give an opinion of "Fail" for the adequate illumination?

Generally no, the assessment of illumination should take in to account measurements and observations of all spaces, and is not necessarily contingent upon one occupied space meeting the minimum recommended levels. It is the responsibility of the PE to determine, based on his/her professional opinion, whether the building lighting system meets the minimum recommended illumination levels for the current occupancy, given all measured data and observations at the time of the site visit.

Outside Air Ventilation

Purpose

To determine if the interior occupied spaces of the building and the generally unoccupied spaces (for example, parking garages and parking lots) associated with the building are maintaining current industry standards for quantity of outdoor air provided.

Standard

ASHRAE Standard 62-1999, Ventilation for Acceptable Indoor Air Quality.

Background

According to ASHRAE Standard 62, acceptable ventilation for indoor air quality is a function of the type of building space, building floor area, and number of occupants. A full range of required supply rates of outside air for acceptable indoor air quality is detailed in the body of ASHRAE Standard 62. A sample of the required outdoor air supply rates, in units of cubic feet per minute (CFM), for various indoor function space (for example, office, classrooms, computer rooms, etc.) are given in the table below. Please refer to ASHRAE Standard 62 for the outdoor air supply rates of interior functional spaces not given below.

Acceptable Outdoor Air Supply Rates

Per ASHRAE Standard 62, the required outdoor air supply rates for acceptable indoor air quality are as follows:

Functional Space	Outdoor Air Supply Rate	Notes
Office		
Office Space	20 cfm/person	
Reception Areas	15 cfm/person	
Conference Rooms	20 cfm/person	
Duplicating/Printing Rooms	0.50 cfm/ft^2	Positive exhaust and contaminant control
K-12 School		
Classrooms	15 cfm/person	
Laboratories	20 cfm/person	
Auditoriums	15 cfm/person	
Libraries	15 cfm/person	
Music Rooms	15 cfm/person	
Locker Rooms	0.50 cfm/ft^2	
Supermarket		
Supermarkets (customer space)	15 cfm/person	
Meat Processing	15 cfm/person	

Hotel/Motel		
Bedrooms/Living Rooms	30 cfm/room	
Bathrooms	35 cfm/room	Intermittent use
Lobbies	15 cfm/person	
Conference Rooms	20 cfm/person	
Bars/Cocktail Lounges	30 cfm/person	Supplemental smoke removal
Coin-operated Laundries	15 cfm/person	
Ballrooms	25 cfm/person	
Hospital		
Patient Rooms	25 cfm/person	
Medical Procedure Rooms	15 cfm/person	
Operating Rooms	30 cfm/person	
Recovery and Intensive Care	15 cfm/person	
Autopsy Rooms	0.50 cfm/ft^2	
Physical Therapy	15 cfm/person	
Other Spaces		
Cafeterias/Dining Rooms	20 cfm/person	
Kitchens (cooking)	15 cfm/person	
Computer Rooms/Data Centers	20 cfm/person	
Smoking Lounges	60 cfm/person	Local exhaust and no re-circulation
Corridors	0.05 cfm/ft^2	
Elevators	1.00 cfm/ft^2	
Public Restrooms (per toilet fixture)	50 cfm/person	
Commercial Laundry Rooms	25 cfm/person	
Swimming Pools (Pool & Deck Area)	0.50 cfm/ft^2	
Parking Garages	1.50 cfm/ft^2	

Expectations of the PE

The PE is expected to give a professional opinion about the capability of the building to supply acceptable outdoor air per ASHRAE Standard 62. In so doing, the PE should first determine the volume of outside air required by the space based on the outdoor air supply rates above. Once the minimum acceptable volume outside air for the space in question is known, the PE may directly measure the volume of outside air entering the supply air fan chamber or calculate this figure based on the operating characteristics of the air-handling unit as witnessed during the site visit using mass balance equations. Ultimately, it is the responsibility of the PE to determine, based on his/her professional opinion, whether the building meets the letter and spirit of ASHRAE Standard 62 considering all measured data and observations at the time of the site visit.

Hints & Tips

Reviewing previous indoor air quality reports or testing, adjusting, and balancing (TAB) reports is generally *not* acceptable as the sole means to give a professional opinion about the capability of the building to provide acceptable outside air.

The PE should make an effort to measure the outdoor airflow directly. If this is not feasible due to air-handling unit design or configuration, the PE should calculate the percentage of outdoor air by mass balance equations.

In buildings having repetitive occupant and HVAC configurations, direct measurement of a sampling of air-handling units may be acceptable. Each air-handling unit, however, should be inspected to determine if it is operating properly.

Central energy management control systems (EMCS) or direct digital control (DDC) systems can provide real-time information about an air-handling unit's operating status. PEs may use this information at their discretion as a means to give an opinion about the ability of the building to meet ASHRAE Standard 62.

Outside Air Ventilation Q&A

Is the building required to be mechanically ventilated to meet ASHRAE Standard 62?

Generally, yes. However, some buildings (for example, K-12 schools) were designed to be naturally ventilated. Determining whether such buildings meet the outdoor air ventilation requirements of ASHRAE 62 would necessitate a calculation by the PE.

Are outside air measurements or calculations required for every occupied space within the building?

No. It is expected that the PE will take a representative sampling of the occupied spaces to be able to give his/her decision. There are several factors that might influence a PE's decision or warrant further measurement. For example, if a significantly sized space is marginally meeting the minimum requirements, then more measurements may be warranted. Similarly, if there are a significant number of personal fans, indicating stagnate air, or damaged and/or occupied-altered HVAC equipment (for example, diffusers and thermostats), the PE may want to consider additional measurements in these areas.

If the measured outdoor air supply of a single occupied space is below the acceptable supply rates given in ASHRAE Standard 62, is that, in and of itself, sufficient grounds to give an opinion of "Fail" for ventilation?

The answer depends upon the space itself and is ultimately the judgment of the PE. If the ventilation rate in an open office plan within a given building, for example, does not meet ASHRAE Standard 62, then it would be expected that the PE would give the building to "fail" the ventilation requirement. However, if the outdoor supply rate for a single private office of dozens of offices does not meet ASHRAE Standard 62 and the remainder of the building is deemed to meet the standard, then it would be expected that the PE would give the building to "pass" the ventilation requirement. Generally the outdoor air supply assessment should take in to account all measurements and observations, and is not necessarily contingent upon one occupied space meeting the ventilation requirements. It is the responsibility of the PE to determine whether the building meets the letter and spirit of ASHRAE Standard 62 after considering all measured data and observations.

Why are TAB reports and Indoor Air Quality assessments generally not acceptable for assessing whether acceptable outside air ventilation is being provided?

The principal reasons are two-fold: 1) the assessment is intended to be a professional opinion at the time of the site visit; and 2) the assessment is intended to be based upon the measurements and observations of the PE hired to perform the assessment. TAB reports and IAQ assessments can be quite useful for the PE to review though as they may provide confirmation of the PE's measurements and observations as well as indicate problematic areas worthy of the PE's attention.

Indoor Air Pollutants

Purpose

To determine if the interior occupied spaces of the building and the generally unoccupied spaces (for example, parking garages and parking lots) associated with the building are maintaining current industry standards for control of indoor air pollutants.

Standard

ASHRAE Standard 62-1999, Ventilation for Acceptable Indoor Air Quality.

Background

In addition to providing outdoor air requirements for ventilation of commercial facilities, ASHRAE Standard 62 provides guidelines for the control of common indoor air pollutants in the United States. ASHRAE Standard 62-1999 prescribes two basic procedures for providing acceptable indoor air quality in buildings: the Ventilation Rate Procedure or the Indoor Air Quality Procedure. The Ventilation Rate procedure prescribes various ventilation rates (rates of outside air) for various space types. The Ventilation Rate Procedure for prescribing required ventilation rates, while meeting the standard for provides only an indirect solution to the control of indoor contaminants[1] See section 6.2 of Standard 62-1999 for the Indoor Air Quality procedure that outlines an alternative method of control of indoor air pollutants. The procedure outlined describes a direct solution by restricting the concentration of known contaminants of concern to some specified acceptable levels.[2]

Acceptable Control of Indoor Air Pollutants

Per ASHRAE Standard 62, each of the following spaces require: direct exhaust of the room (for example, source) air to the outdoors with proper placement of exhausts to minimize occupant exposure; and negative pressure relative to occupied spaces. Additionally, all chemical/source containers are required to be fully sealed.

- Printing facilities or large copy rooms
- Cooking facilities
- Smoking lounges *
- Enclosed garages **
- Chemical storage rooms (including those rooms that store cleaning supplies, pesticides, paints, lubricants, and adhesives)
- Rest rooms or bathrooms
- Repair shops or machine rooms
- Mechanical rooms
- Dry cleaning facilities
- Hair/nail salons

* - requires 60 cfm per person of outside air makeup

** - requires 1.50 cfm/ft^2 outside air makeup

[1] ASHRAE Standard 62-1989, Section 6.2 Indoor Air Quality Procedure, p. 12, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE), Atlanta, GA, 1989.
[2] Ibid, p. 12.

Additionally, conformance to the following requirements must be verified:

1) **Smoking Policy**: A written smoking policy that prevents involuntary exposure to secondhand smoke by either: a) prohibiting smoking throughout the building; or b) restricting smoking to areas that are separately ventilated, maintained under negative pressure, and directly exhausted to the outside per ASHRAE Standard 62-1999, Section 4.4.2 – Supply of Outdoor Air.

2) **Microbiological Sources**: The building should be free of visible signs of microbiological sources such as mold and mildew. ASHRAE Standard 62-1999, Section 5, Systems and Equipment, describe conditions and equipment that should be evaluated to ensure proper control of microbial sources.

3) **Combustion Sources**: All equipment which involves the combustion of fossil fuels or other materials should be exhausted directly to the outside with no possibility of back draft.

Expectations of the PE

The PE is expected to give a professional opinion about the capability of the building to control indoor air pollutants per ASHRAE Standard 62. In so doing, the PE should visually verify that the spaces listed above are both directly exhausted to the outdoors and under negative pressure relative to the occupied spaces. The PE should also observe that the smoking policy of the building, as listed above, is being conformed to by the occupants of the building. Additionally the PE should observe no clear signs of microbiological sources of indoor air pollutants and observe that all equipment involving combustion be exhausted directly to the outside. It is the responsibility of the PE to determine, based on his/her professional opinion, whether the building meets the letter and spirit of ASHRAE Standard 62 considering all measured data and observations at the time of the site visit.

Hints & Tips

Reviewing the most current, written, preventative maintenance plan can provide useful insight about the level of concern placed upon the control of indoor air pollutants. A well written preventive maintenance plan should document the procedures used in the building to monitor, inspect, and clean all HVAC components for proper operation.

Reviewing previous indoor air quality reports or testing, adjusting, and balancing (TAB) reports is generally *not* acceptable as the sole means to give a professional opinion about the capability of the building to provide acceptable outside air.

Outdoor airflow should be measured directly. If this is not feasible due to air-handling unit design or configuration, the PE should calculate the percentage of outdoor air by mass balance equations.

In buildings having repetitive occupant and HVAC configurations, direct measurement of a sampling of air-handling units may be acceptable. Each air-handling unit, however, should be inspected to determine proper operation.

Central energy management systems (EMS) or direct digital control (DDC) systems can provide real-time information about an air-handling unit's operating status. A PE may use this information at their discretion upon validation of a representative sample of air-handling units as a means to give an opinion about the ability of the building to meet ASHRAE Standard 62.

Review ANSI/ASHRAE Standard 52.1-1992, *Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter*

Indoor Air Pollutants Q&A

Does the PE need to inspect every mechanical room, janitor closet, etc. throughout a building to ensure there are no open chemical containers?

No. It is expected that the PE will take a representative sampling of the unoccupied spaces to be able to give his/her decision.

If a single private office is not preventing the involuntary exposure to secondhand smoke, is this grounds for failure?

Yes. The policy of the building must be to only allow smoking in designated smoking lounges that are both directly exhausted to the outdoors and under negative pressure relative to the occupied spaces.

Are private offices having direct exhaust to the outdoors and under negative pressure relative to the surrounding occupied spaces that permit smoking in conformance with the smoking policy requirement?

No. Only designated areas (for example, smoking lounges) under negative pressure and directly exhausting to the outdoors are permitted.

If a single mechanical room or janitor's closet is not adequately controlling indoor air pollutants (for example, open containers), is this grounds for failure?

The answer depends upon the space and source of pollutant and is ultimately the judgment of the PE. If the only observed indoor air pollutant transgression is an uncovered drum of mild cleaning solution used to clean the floors, for example, in a single janitorial closet of twenty such janitorial closets, then a PE could reasonably be expected to give the building to "pass" the control of indoor air pollutants. However, if the PE observes a single instance of an uncovered container of a known volatile indoor air pollutant such as formaldehyde, or even a high rate of janitorial closets with uncovered drums of mild cleaning solution, then the PE could reasonably be expected to give the building to "fail" the control of indoor air pollutants.

Contact Information

Mailing Address

ENERGY STAR Label for Buildings
U.S. Environmental Protection Agency (6202J)
1200 Pennsylvania Avenue, NW
Washington, DC 20004

Hotline

1-888-STAR-YES (1-888-782-7937)

E-mail

energystarbuildings@epa.gov

Web-site

www.energystar.gov

For the following standards:

ANSI/ASHRAE Standard 52.1-1992, *Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter*

ANSI/ASHRAE Standard 55-1992, *Thermal Environmental Conditions for Human Occupancy*

ANSI/ASHRAE Standard 62-1999, *Ventilation for Acceptable Indoor Air Quality*

American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE)
Publication Sales Department
1791 Tullie Circle, NE
Atlanta, GA 30329

Tel: (404) 636-8400

Web URL: www.ashrae.org

E-mail: n/a

For the following standard:

IESNA, *Lighting Handbook: Reference & Application, 9th Edition*

Illuminating Engineering Society of North America (IESNA)
120 Wall Street, 17th Floor
New York, NY 10005

Tel: (212) 248-5000

Web URL: www.iesna.org

E-mail: iesna@iesna.org

Professional Engineer Qualifications

In addition to having a current registration as a PE and being in good standing, a PE must have the following qualifications to validate the Statement of Energy Performance, regardless of whether it is used to apply for the ENERGY STAR label or is used for any other private purpose:

- A current license in the state where the building is located, or a license in a state that has a reciprocal agreement with the state where the building is located.

  Exception: Professional engineers employed by the Federal government may evaluate any buildings located in the United States that are owned or primarily occupied by the Federal government. Contractors and consultants to the Federal government, however, are not covered by the exception.

- A license in a discipline related to commercial building systems, such as mechanical or electrical.

  - Working knowledge of ASHRAE Standard 55-1992, ASHRAE Standard 62-1999, and IESNA Lighting Handbook.

STATEMENT OF ENERGY PERFORMANCE
Main Street Building - 11/10/1999

Building

Main Street Building
1234 Main Street
Washington, DC 20005
Gross Building Area (ft^2): 498,000
Year Built: 1989

Building Owner

Angelo Tippy
1602 Independence Street
Washington, DC 20005
Contact Name: Jean-Luc Cretienne
Contact Phone: 202-555-1212

Building Space Use Summary

	Area: (ft^2)	Occupants	Occupancy Hours/Week	Computers
Office:	493,346	1,215	102	1,200
Computer Room/Data Center:	4,654	-	168	-
Parking Garage (attached):	135,000	-	168	-

Site Energy Use Summary (10/13/98 to 10/11/99)

Electricity (kBtu)	**Total Energy (kBtu)**
33,414,330	**33,414,330**

Normalized Benchmark Data

	ENERGY STAR	Your Building
Benchmarking Score:	**75**	**77**
Energy Intensity:		
Site (kBtu/ft^2-yr):	**57**	**55**
Source (kBtu/ft^2-yr):	**171**	**166**
Emissions:		
CO_2 (1000 lbs/yr):	**21,154**	**20,527**
SO_2 (1000 lbs/yr):	**140**	**136**
NO_x (1000 lbs/yr):	**34**	**33**
Energy Cost:		
($):	**842,161**	**817,189**
($/$ft^2$-yr):	**1.33**	**1.29**

Indoor Environment Criteria

INDOOR AIR POLLUTANTS CONTROLLED?	**PASS**
ADEQUATE VENTILATION PROVIDED?	**PASS**
THERMAL CONDITIONS MET?	**PASS**
ADEQUATE ILLUMINATION PROVIDED?	**PASS**

Professional Verification

Jason Jeter, Professional Engineer
Jeter, James and Jones Engineering
Street Address: 1701 Irving Street
City, State: Washington, DC 20036
Phone Number: 202-123-1234

Professional Engineer Stamp

Based on the conditions observed at the time of my visit to this building, I certify that this statement is accurate.

Appendix B

List of Definitions

Office space is defined as building space that is used for general office, professional and administrative purposes. Relevant businesses and industries include banks, insurance, real estate, securities, brokerage firms, consulting, corporate, engineering, law, management, medical, mixed professional, computer center, and data entry.

K-12 school space is defined as building space that is used for the teaching of children in Kindergarten through twelfth grade; that is, elementary or primary, intermediate or secondary, and high school, or children in a comparable age range.

Hospital space is defined as a building or set of buildings (campus) that are used for the diagnosis, treatment, and temporary housing of patients with acute care needs. Children's hospitals also fit this definition.

- Acute care hospitals provide short-term medical treatment for patients having an acute illness or injury or recovering from surgery.
- Children’s hospitals offer specialized pediatric treatment for children and infants including acute care, cancer therapy, and rehabilitation care.

Supermarket/grocery store space is defined as a building that is used for the retail sale of food and beverage products and that has a minimum total area of 5,000 square feet. Floor area for all supporting functions, such as warehouse, offices, break-room, and storage areas, etc., should be included in the total.