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Copper Alliance®

Building Better: A Guide to Copper in Green and Healthy Buildings

Introduction

By using copper, the sustainable building community can create structures with features that not only preserve the integrity of the environment, but also promote occupant health and wellbeing. An impressive and dynamic array of designs, technologies and products are available to support smarter, greener and healthier buildings.

This guide highlights some of the building features that both appeal to owners and provide benefits to tenants. It includes details on how leading green and healthy building standards recognize these features, for projects pursuing Leadership in Energy and Environmental Design (LEED) or WELL Building Standard™ (WELL) certification or following the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 189.1 standard.

For any project, regardless of certifications pursued or standards followed, this guide provides ideas and clear benchmarks for making buildings better. It also emphasizes the vital, growing role of copper as the essential element in green and healthy buildings.

Note: This guide provides information from LEED version 4 for Building Design and Construction, WELL version 1 and ASHRAE 189.1-2014.



Green and Healthy Buildings: Copper at the Core

Electric Vehicles

Electric vehicle (EV) technology has advanced steadily, with its status evolving from a dream to a practical reality. A current barrier to expanding EV deployment is widespread installation of charging infrastructure. A 2017 report by the Institute for Electric Innovation estimates **five million charging stations** will be needed to support the **seven million EVs** expected to be on the road globally by 2025. The built environment plays a significant role in meeting this demand when it includes EV charging stations.

Copper has a primary function in **both EV charging stations and EVs themselves** because of its durability, reliability and superior electrical conductivity. Copper wiring in EV charging stations ensures the fastest possible charging times. Copper is also used in grounding systems, making these stations safe and resilient. Secure cable interconnections, which guarantee efficient performance, are made possible by copper alloys.

The sustainable building community can help advance EV adoption and offer amenities to occupants with EVs. LEED and ASHRAE provide helpful benchmarks for providing EV charging stations in commercial buildings.

Green Vehicles

LEED Credit

Awards one credit for new or renovated commercial and institutional buildings providing both preferred parking for green vehicles and alternative-fuel fueling stations by:

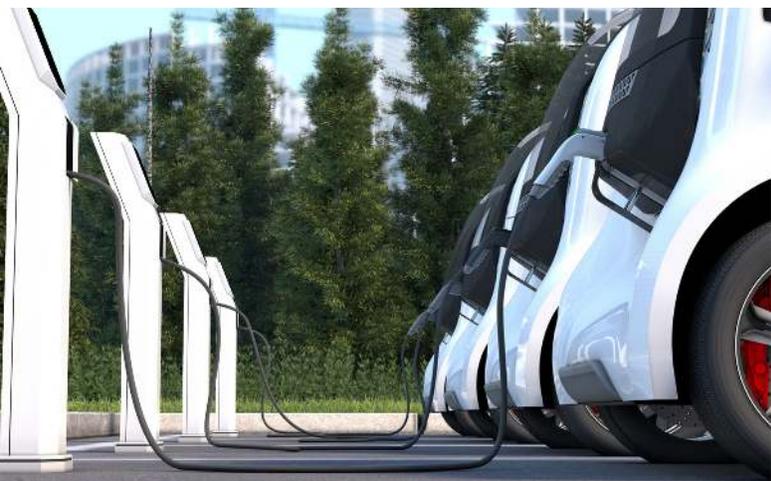
- Installing electrical vehicle supply equipment (EVSE) in 2 percent of all parking spaces used by the project; or
- Installing liquid or gas alternative fuel fueling facilities or a battery switching station capable of refueling a number of vehicles per day equal to at least 2 percent of all parking spaces.

The credit requirements for warehouses and data centers include providing an on-site fleet with at least one yard tractor powered by electricity, propane, or natural gas, and providing on-site charging or refueling stations for these vehicles (with liquid or gas refueling stations separately ventilated or located outdoors).

Site Vehicle Provisions

ASHRAE Mandatory Provision 5.3.7.3

Promotes building codes mandating new and renovated buildings (with an occupant load over 100 and on-site vehicle parking) to have preferred parking spaces or provisions for EV charging infrastructure, where two or more EV charging systems are available to building occupants and located no more than 400 m (0.25mi) from the building project.



Active Transportation

Walking, running or cycling to work measurably improves health and wellbeing. A 2017 *British Medical Journal* study reports people who cycle to work are **45 percent less likely** to develop cardiovascular disease or cancer than people who drive or take public transport. It also shows employers can reduce lost time due to illness by supporting cycle commuting. The built environment reduces barriers to cycling, running or walking to work when it provides people with a place to shower when they arrive.

Copper is the material of choice in plumbing systems for both showers and sinks in hospitals, schools, retail and other commercial buildings because it is durable, strong, corrosion resistant and naturally antimicrobial. The high electrical conductivity of copper means it plays an essential role in automated, water-saving controls for showers and sinks. Copper is also fundamental to the electrical systems powering ventilation fans, providing well-lit shower and changing spaces and enabling efficient time and motion sensors for water use and lighting. In a more visible role, copper is a component of brass faucets, shower heads, drains, assistance railings and other restroom fixtures and fittings.

The sustainable building community can promote occupant wellness by tangibly encouraging alternative commuting methods. Both LEED and WELL promote showers and changing facilities in new and renovated commercial buildings.

Bicycle Facilities

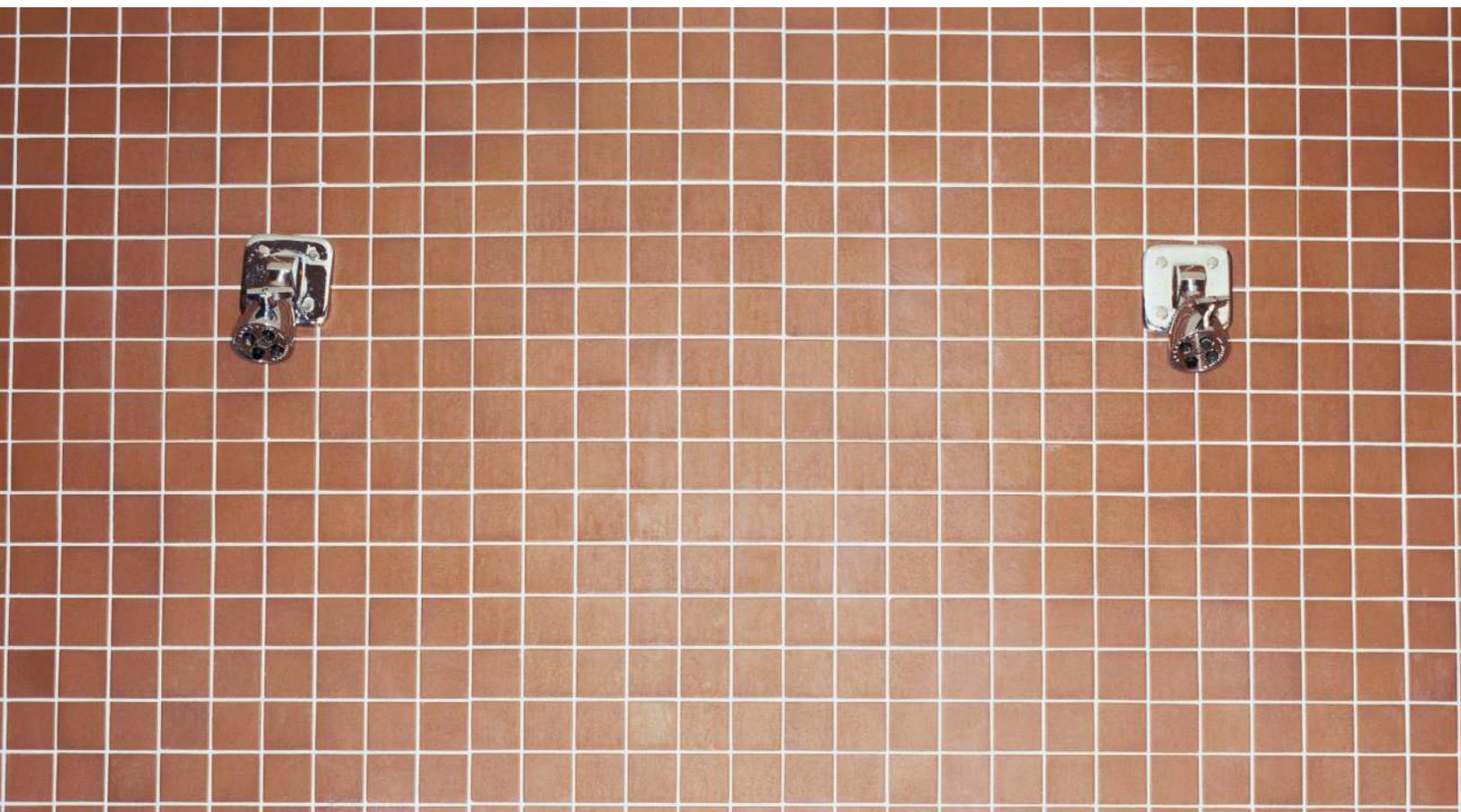
LEED Credit

Awards one credit for new or renovated commercial and institutional buildings installing at least one on-site shower with a changing facility for the first 100 regular building occupants, plus one additional shower for every 150 regular building occupants thereafter. This includes data centers, warehouses and distribution centers, hospitality buildings, schools, retail and healthcare facilities.

Active Transportation Support

WELL Feature 69

Recognizes new and existing commercial and institutional buildings which, among other requirements, install one shower with a changing facility for the first 100 regular building occupants, plus one additional shower for every 150 regular building occupants thereafter, onsite or within 200 m (650 ft) of the building's main entrance.



Reduced Water Use

Industrial uses account for over 40 percent of the available clean water in developed countries. As aging water infrastructure requires replacement, the costs of this water and associated wastewater services rise. According to the U.S. Environmental Protection Agency (EPA), wastewater costs have risen at a rate well above the consumer price index since the early 2000s. Using less water means spending less money on water and wastewater treatment, and on energy to heat, store and move water through buildings. The built environment supports water conservation – and increases cost savings – when it incorporates low flow fixtures and efficient water systems.

Nearly **80 percent** of all utilities choose copper for water service lines because it is reliable and recyclable and does not allow potentially dangerous contaminants to permeate through or leach from the tube walls – keeping treated water safe. Inside buildings, copper wiring has an important function in automated water conservation technologies, such as no-touch faucets and automatic-flush toilets. Copper's thermal properties drive its use in the water-saving, closed-loop or air-cooled technologies often incorporated into cooling appliances and equipment. Thermal recovery heat exchangers also use copper to reduce water use in buildings and reclaim heat energy, which would otherwise be lost to the wastewater system, by efficiently transferring energy from one fluid, gas or heated air to another. Above all, measuring water use at multiple locations and for multiple activities helps facility managers better track and conserve water. Copper alloys are a core part of the water meters and plumbing system controls required for such monitoring.

The sustainable building community can, by design and with technology, support water conservation. LEED and ASHRAE promote equipment that uses less water and increased metering to better track water consumption in new and renovated commercial buildings.



Indoor Water Use Reduction

LEED Prerequisite and Credit

Requires new or renovated commercial and institutional buildings to:

- Reduce aggregate water consumption from fixtures and fittings 20 percent over a baseline value;
- Install appliances, equipment and processes within the project scope meeting specified performance criteria (see LEED version 4 for details).

Awards up to six credits for going beyond these requirements, including using alternative water sources.

The credit requirements for school, retail, hospitality and healthcare buildings also include reducing the use of appliance and process water.

Building Level Water Metering

LEED Prerequisite

Requires new or renovated commercial and institutional buildings to increase the number of permanent water meters measuring the total potable water use for the building and associated grounds, and compile data into monthly and annual summaries (manual or automated).

Water Metering

LEED Credit

Awards one credit to new or renovated commercial and institutional buildings installing permanent water meters for two or more of the following water subsystems: irrigation; indoor plumbing fixtures and fittings; domestic hot water; boilers; reclaimed water or other process water.

The credit requirements for healthcare building projects include installation of water meters in any five of the following: purified water systems (reverse-osmosis, de-ionized); filter backwash water; water use in dietary departments; water use for laundry; water use in laboratories; water use in central sterile and processing departments; water use in physiotherapy, hydrotherapy and treatment areas; water use in surgical suites; closed-loop hydronic system makeup water; cold-water makeup for domestic hot-water systems.

Water Consumption Management

ASHRAE Provision 6.3.3.1

Promotes codes for new or renovated buildings and new systems and equipment in existing buildings, mandating the installation of:

- Measurement devices with remote communication capability to collect water consumption data for the domestic water supply to the building;
- Monitors or submeters for both potable and reclaimed water entering the building project;
- Separate submeters for individually leased, rented or other tenant or subtenant space within any building totaling in excess of 50,000 ft² (5,000 m²);
- Submeters for any project or building, or tenant or subtenant space within a project or building, where consumption is projected to exceed 1,000 gallons/day (3,800 L/day).

Commercial Food Service Operations (Water Use)

ASHRAE Provision 6.4.2.2

Promotes codes for new, renovated and existing (with equipment upgrades) commercial food service operations mandating the installation of:

- Boilerless/connectionless food steamers;
- Combination ovens not consuming more than 10 gallons/hour (38 L/hour) in full operational mode;
- Air-cooled ice machines complying with the requirements of the ENERGY STAR® Program for Commercial Ice Machines;
- Hands-free equipped faucet controllers (foot controllers, sensor-activated or other) for all faucet fittings within the food preparation area of the kitchen and the dish room, including pot sinks and washing sinks;
- High-efficiency pre-rinse spray valves;
- Dishwashers complying with the requirements of the ENERGY STAR® Program for Commercial Dishwashers.

Energy Efficiency and Management

A sustainable energy future depends on the twin pillars of energy efficiency and renewable energy. Reducing the amount of energy required to provide products and services is among the most cost-efficient and large-scale opportunities to reduce carbon emissions and other pollution. Globally, minimum energy performance standards for air conditioners, refrigeration systems, motors and other applications are driving the design of more efficient equipment. For building owners and tenants, the benefits of installing these types of equipment include lower electricity bills and often less indoor noise.

Copper has the highest electrical conductivity of all non-precious metals, making it the material of choice for wires, cables and electrical equipment. All other factors being equal, higher electrical conductivity means higher energy efficiency or, for the same efficiency, more compact designs. Without copper, electrical equipment such as motors, transformers and cables would use 20 percent more material for the same efficiency rate, which would result in them being larger and potentially heavier. Over their lifetimes, electrical systems containing one tonne of copper will result in reduced CO₂ emissions – **between 100 and 7,500 fewer tonnes of CO₂** – compared to using non-copper alternatives. Copper also conducts heat better than other metals, which is important for efficient heat exchangers and heat sinks in electronic components.

When it comes to energy efficiency, copper's role extends beyond energy-using products. Energy savings are realized through the copper wires and cables incorporated into energy measurement and control devices, as well as automatic stand-by and shut-off features. Frequently, the energy and CO₂ savings associated with these system-level applications are orders of magnitude larger than those seen at the product level.

The sustainable building community can attract owners and tenants interested in saving money and conserving energy while making progress towards climate goals. LEED and ASHRAE both recognize measures to incorporate energy saving designs and technologies into new and renovated buildings.



Minimum Energy Performance

LEED Prerequisite and Credits

Requires new or renovated commercial and institutional buildings to have a minimum level of whole-building energy performance show an improvement of 5 percent for new construction, 3 percent for major renovations or 2 percent for core and shell projects, versus the baseline building performance rating.

Awards up to 20 credits to building projects meeting an energy performance target following specific criteria (see LEED version 4 for details). More credits are awarded for more ambitious targets, according to type of building (e.g., retail, healthcare, school, etc.).

Energy Consumption Management

ASHRAE Mandatory Provision 7.3.3.1

Promotes codes for new or renovated buildings and new systems and equipment in existing buildings, mandating the installation of measurement devices with remote communication capability to collect energy consumption data for each energy supply source to the building, including gas, electricity and district energy, exceeding specified thresholds (see ASHRAE 189.1 for details).

Minimum Equipment Efficiencies for the Alternate Renewables Approach

ASHRAE Provision 7.4.3.1

Promotes codes for new or renovated buildings mandating heightened requirements for the efficiency of heating, ventilating and air conditioning equipment (see ASHRAE 189.1 for details).

Supermarket Heat Recovery

ASHRAE Provision 7.4.7.2

Promotes codes for new or renovated supermarkets (>25,000 ft² / 2500 m²) and existing supermarkets with new equipment, mandating the recovery of waste heat from the condenser heat rejection on permanently installed refrigeration equipment.

Television Control, HVAC Setpoint Control, and Ventilation Control

ASHRAE Provisions 7.4.3.9.2, 7.4.3.9.3 and 7.4.3.9.4

Promotes codes for new and renovated rental and hotel properties mandating the installation of automatic off-, sleep- or standby-mode functions for televisions, heating and air conditioning equipment (including automated set-points) and ventilation equipment (including automated shut-off for outdoor air supply and exhaust air and an automated preoccupancy purge cycle).



Renewable Energy

A diverse array of renewable energy generation technologies continues to come online around the world. Global supply growth for solar and wind are forecast to reach an average **annual percentage of 11 and 7**, respectively, between 2015 and 2035. Growth is projected to be the greatest across European countries, followed closely by China and North America. These regions have grown investments in renewables between 5 and 10 percent since 2015. By 2035, solar is predicted to represent 35 percent of India's power generating capacity and 7 percent of China's. Wind in Europe and China is projected to generate 21 and 18 percent, respectively. The built environment presents a meaningful opportunity to improve electrical distribution resiliency and optimize supply utilization by integrating renewable energy technologies directly into new-build or renovation designs. Commercial buildings in particular can harness the benefits of on-site renewable energy and its cost-saving advantages for owners and occupants.

Copper is a critical component in **solar energy systems** due to its exceptional electrical and thermal conductivity and high resistance to both atmospheric and aqueous corrosion. It is used in both the wiring to connect and grounding to protect photovoltaic (PV) systems. Copper is also integral to the electrical generators, connections and protective grounding systems of **wind energy technologies**.

The sustainable building community can help bring more renewable energy online while owners benefit from local incentives and attract occupants with reduced electricity costs. Both LEED and ASHRAE promote the inclusion of on-site renewable energy.

Heat Island Reduction

LEED Credit

Awards up to two credits for new or renovated commercial and institutional buildings:

- Placing a minimum of 75 percent of parking spaces undercover and installing energy generation systems, such as solar thermal collectors, photovoltaics and wind turbines, on that roofing space; or
- Providing shade with structures covered by energy generation systems, such as solar thermal collectors, photovoltaics and wind turbines.

(Alternative paths to achieve the Heat Island Reduction credits include non-roof paving alternatives, as well as non-roof and vegetated roof-cover options – see LEED version 4 for details).

Renewable Energy Production

LEED Credit

Awards one, two or three credits for providing 1, 5 or 10 percent of the building's energy consumption from renewable energy systems such as photovoltaics and wind, to offset building energy costs.

Standard Renewables and Alternate Renewables

ASHRAE Provisions 7.4.1.1.1 and 7.4.1.1.2

Promotes building codes for new or renovated buildings and new systems and equipment in existing buildings, mandating the installation of on-site renewable energy systems meeting specified criteria (see ASHRAE 189.1 for details).

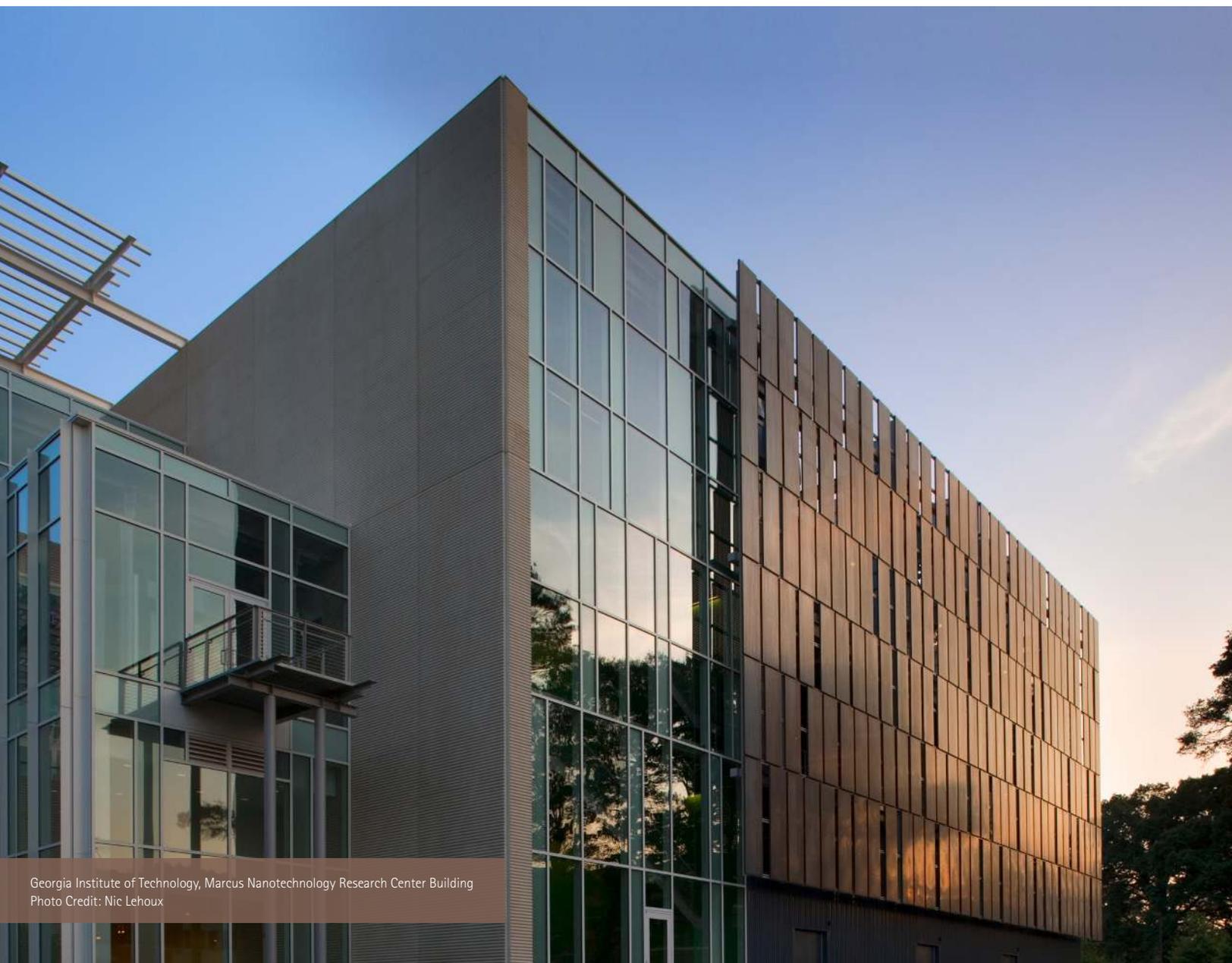


Lighting and Shading Controls

Including natural lighting in buildings helps regulate human circadian rhythms. Natural lighting is known to **boost both comfort and productivity**, while using 20 percent less electricity than that required for a conventionally lit building. With an upsurge in design for natural light, external shading systems and **automated shading control systems** play an important role in guaranteeing light is not too bright, avoiding glare and preventing thermal gains from overloading HVAC systems.

Copper is key to the automation and controls allowing occupants to adjust their space to reliably receive adequate natural light without being uncomfortable in direct sun or distracted by glare. It is also used in architectural design features doubling as exterior shading systems.

The sustainable building community can provide natural light for wellness and productivity, as well as shading for comfort. ASHRAE promotes office space shading and WELL directly recognizes both solar glare control technologies and automated shading controls. In addition, LEED supports individual lighting and glare controls to adjust conditions according to tasks and preferences.



Solar Glare Control

WELL Feature 56

Recognizes new and existing commercial and institutional buildings with one of three specific window shading measures, including:

- Interior window shading or blinds controllable by the occupants or set to automatically prevent glare;
- External shading systems set to prevent glare; or
- Variable opacity glazing, such as electrochromic glass, reducing transmissivity by 90 percent or more.

Also recognizes buildings with one of the following specific daylight management measures:

- Interior window shading or blinds controllable by the occupants or set to automatically prevent glare;
- External shading systems set to prevent glare;
- Interior light shelves to reflect sunlight toward the ceiling;
- Film of micro-mirrors on the window reflecting sunlight toward the ceiling; or
- Variable opacity glazing, such as electrochromic glass, reducing transmissivity by 90 percent or more.

Automated Shading and Dimming Controls

WELL Feature 60

Recognizes new and existing commercial and institutional buildings in which all windows larger than 0.55 m² [6 ft²] have shading devices that automatically engage when light sensors indicate sunlight could contribute to glare at workstations and other seating areas.

Also recognizes buildings in which all lighting (except decorative fixtures) in major workspace areas is programmed using occupancy sensors to automatically dim to 20 percent or less (or switch off) when the zone is unoccupied, and all lighting (except decorative fixtures) has the capacity and is programmed to dim continuously in response to daylight.

Daylight

LEED Credit

Awards up to two credits for new or renovated commercial and institutional buildings providing manual or automatic (with manual override) glare-control devices for all regularly occupied spaces using one of three options (see LEED version 4 for details).

Office Space Shading

ASHRAE Provision 8.4.1.3

Promotes codes for new or renovated buildings and new systems and equipment in existing buildings, mandating each west-, south- and east-facing façade to be designed with a shading projection factor (PF) not less than 0.5 (shading can be external or internal using the interior PF). Shading devices can include louvers, sun shades, light shelves and any other permanent device, as well as building self-shading through roof overhangs or recessed windows.

Interior Lighting

LEED Credit

Awards up to two credits for new or renovated commercial and institutional buildings with one or both of:

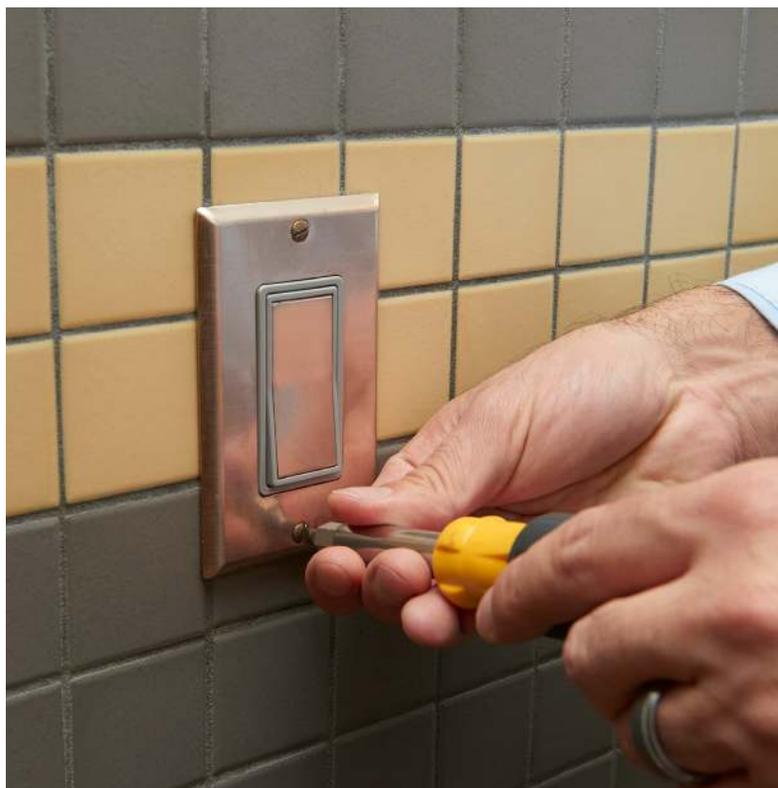
- Direct-only overhead lighting for 25 percent or less of the total connected lighting load for all regularly occupied spaces;
- At least 90 percent of individual occupant spaces with individual lighting controls enabling occupants to adjust the lighting to suit their individual tasks and preferences, with at least three lighting levels or scenes (on, off, and midlevel at 30 percent to 70 percent of maximum illumination level, not including daylight contributions) and, for shared multi-occupant spaces, meet all of the following:
 - Contain multizone control systems enabling occupants to adjust the lighting to meet group needs and preferences with at least three lighting levels;
 - Ensure lighting for presentation or projection walls are separately controlled;
 - Locate switches or manual controls in the same space as the controlled luminaires giving a person operating the controls a direct line of sight to the controlled luminaires.

Indoor Air Quality

The quality of indoor air is critical to maintaining occupant wellbeing and, as such, presents an opportunity to provide owners and occupants with both productivity and health benefits. A recent study by the Healthy Buildings Program at the Harvard Center for Health and the Global Environment linked improved indoor air quality in office environments with **increased cognitive function** across nine cognitive domains, including strategy and information usage. It concludes "even modest improvements to indoor environmental quality may have a profound impact on the decision-making performance of workers." Products and materials used in buildings can emit a range of indoor air pollutants, including volatile organic compounds (VOCs), formaldehyde and other potentially harmful substances. Further, the methods used to clean the building contribute to air quality. Knowing how building products and materials will need to be cleaned, and whether there are low- or non-emitting options available, should inform decisions made during the building project.

The copper industry shares information about the role copper plays in a healthy indoor environment. **Health Product Declarations (HPDs) are available** for a variety of copper applications used both behind the wall and for interior applications. For high-touch surfaces inside the building, the broad-spectrum **antimicrobial properties of copper alloys** – backed by a public health registration with the U.S. EPA – provide uninterrupted defense against infection-causing bacteria including the antibiotic-resistant superbug MRSA. Ventilation also has a major influence on the quality of air inside a building. Due to copper's superior electrical and thermal conductivity, it is a central component of efficient ventilation equipment and the automation, sensors and controls that keep this equipment running optimally and maximize occupant comfort. Finally, because copper is an inherently low-emitting material, it is safe for use in a variety of decorative and interior applications.

The sustainable building community can specify ventilation designs and technologies, as well as building materials, products and interiors contributing to cleaner indoor air and improved comfort for occupants. LEED, WELL and ASHRAE all recognize improved air quality, and also serve as benchmarks for any building project team.



Minimum Indoor Air Quality Performance

LEED Prerequisite

Requires new or renovated commercial and institutional buildings to install increased air flow and air quality (carbon monoxide) monitoring devices for either mechanically or naturally ventilated spaces.

Ventilation Controls for Densely Occupied Spaces

ASHRAE Provision 7.4.3.2

Promotes codes for new or renovated buildings and new systems and equipment in existing buildings, mandating demand control ventilation (DCV) for densely occupied spaces served by systems with one or more of the following:

- An air-side economizer;
- Automatic modulating control of the outdoor air dampers;
- Design outdoor airflow greater than 1000 cfm (500 L/s).

Increased Ventilation

WELL Feature 15

Recognizes new and existing commercial and institutional buildings increasing outdoor air supply by exceeding ASHRAE outdoor air supply rates (provided in WELL) by 30 percent, for all regularly occupied spaces.

Direct Source Ventilation

WELL Feature 17

Recognizes new and existing commercial and institutional buildings with all cleaning and chemical storage units, bathrooms and rooms containing printers and copiers (except those meeting certain criteria – see WELL version 1 for details) in rooms that are shut off from adjacent spaces with self-closing doors and exhaust rather than recirculate air.

Low Emitting Materials

LEED Credit

Awards up to three credits for new or renovated commercial and institutional buildings meeting thresholds for low-emitting exterior (healthcare and schools building projects only) and interior product categories (see LEED version 4 for details).

Antimicrobial Activity for Surfaces

WELL Feature 27

Recognizes new and existing commercial and institutional buildings in which all countertops and fixtures in bathrooms and kitchens, and all handles, doorknobs, light switches and elevator buttons are:

- Coated with or comprised of an abrasion-resistant, non-leaching meeting EPA testing requirements for antimicrobial activity; or
- Cleaned with a UV cleaning device with an output of at least 4 mW/cm², used as recommended by the manufacturer.

Material Transparency

WELL Feature 97

Recognizes new and existing commercial and institutional buildings in which at least 50 percent (as measured by cost) of interior finishes and finish materials, furnishings (including workstations) and built-in furniture have some combination of the following material descriptions:

- Declare Label;
- Health Product Declaration (HPD);
- Any method accepted in LEED version 4 "Building Product Disclosure and Optimization – Material Ingredients, Option 1: material ingredient reporting" credit.

Green and Healthy Buildings: Measuring Copper's Contributions

Transparency of Materials and Products – Environmental Impacts and Potential Health Hazards

The sustainable building community expects robust data on the origin of building materials and the environmental impacts those materials generate – both positive and negative – during their production, use and recycling or disposal. Defined by the International Organization for Standardization (ISO) and others, Life Cycle Assessments (LCAs) and Environmental Product Declarations (EPDs) provide such information. Architects, builders, owners and occupants also require data on building material ingredients and their associated potential health hazards, which are provided in HPDs and other transparency documents.

Copper producers work on an ongoing basis to reduce environmental impacts across the life cycle of copper. **Information regarding these efforts** is publicly available, as is an **environmental profile** providing data on the life cycle of copper from the mining stage to copper production. A detailed dataset is also available to help downstream users of copper – such as the manufacturers of an EV charging station or a no-touch faucet control – conduct their own life cycle studies to measure the environmental impacts of their products. LCA data are available for copper **sheet** used in architectural and interior applications; copper **tube** used in plumbing, gas distribution systems as well as air conditioning and refrigeration equipment; and copper **wire** used in building system controls, wind turbines, EV charging stations, ventilation equipment and a myriad of other electrical applications. The copper industry also shares information about the role copper plays in a healthy indoor environment. **HPDs are available** for a growing list of copper applications and alloys.

Building teams can be well informed in their choices, and if they choose, can go further to gain recognition in LEED, WELL and ASHRAE for selecting materials and products with published life cycle (e.g., EPDs) and potential health hazard (e.g., HPDs) data. It is important to ask building product manufacturers to share this information – not only for materials but for the equipment and interior products comprising the final building.



Building Product Disclosure and Optimization – EPDs

LEED Credit

Awards one credit when 20 permanently installed products (from at least five different manufacturers) in new or renovated commercial and institutional buildings (or 50 percent of products by cost) provide life cycle data, which may be in the form of:

- A product-specific, publicly available and critically reviewed ISO 14044 conformant declaration (valued as one-fourth of a product toward the total of 20);
- An industry-wide, externally verified EPD (per ISO 14025, 14040, 14044, and EN 15804 or ISO 21930) (valued as half of a product);
- A product-specific Type III externally verified EPD (per ISO 14025, 14040, 14044, and EN 15804 or ISO 21930) (valued as one whole product).

Product Life Cycle, Industry-Wide Declaration, Product-Specific Declaration or Third-Party Multi-attribute Certification

ASHRAE Provisions 9.4.1.4.1, 9.4.1.4.2 and 9.4.1.4.3

Promotes codes for new or renovated buildings as well as new systems and equipment in existing buildings, mandating the provision of life cycle data for 10 different products installed in the building project at the time of issuance of certificate of occupancy. Data may be in the form of:

- A Type III industry-wide EPD per ISO 14025 and 21930, for which each product complying is counted as one product toward the 10;
- A product-specific Type III EPD per ISO 14025 and 21930, for which each product complying is counted as two products; or
- An LCA per ISO 14040 and 14044, and critically reviewed by a third-party, for which each product complying is counted as two products.

Building Product Disclosure and Optimization – Material Ingredients

LEED Credit

Awards one credit when 20 different permanently installed products (from at least five different manufacturers) in new or renovated commercial and institutional buildings use any of the approved programs (including HPDs – see LEED version 4 for details) to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm).

Material Transparency

WELL Feature 97

Recognizes new and existing commercial and institutional buildings in which at least 50 percent (as measured by cost) of interior finishes and finish materials, furnishings (including workstations) and built-in furniture have some combination of the following material descriptions:

- Declare Label;
- HPD;
- Any method accepted in LEED version 4 "Building Product Disclosure and Optimization – Material Ingredients, Option 1: material ingredient reporting" credit.





Salvaged, Reused and Recycled Content Materials and Products

The ability to recycle materials creates more sustainable production process with significantly less water and energy usage and far less waste. Recycling not only helps meet market demand but most importantly, it minimizes the impact on the environment and safeguards the future. Drawing from recycled stock for new buildings, equipment and infrastructure conserves resources.

Copper is infinitely recyclable. It can be used again and again without losing any of its properties or being downcycled. Recycled copper can be used in the same way as newly mined copper, and it accounts for an estimated two-thirds of the 550 million tonnes of copper produced since 1900 still in productive use. Recycling copper saves energy, extends the life of natural resources, keeps valuable land from being used for landfill and reduces emissions of air pollutants, including greenhouse gases. Because recycling copper requires 85 percent less energy than primary production, its incorporation into products saves 40 million tonnes of CO₂ globally, which is the equivalent of 100 million MWh of electricity or the emissions of 16 million cars.

Building teams can help conserve resources by specifying both materials with recycled content and recyclable materials. These can be used directly in the building construction and indirectly in the equipment and products installed. LEED and ASHRAE recognize the use of recycled content materials.

Building Product Disclosure and Optimization – Sourcing of Raw Materials

LEED Credit

Awards up to two credits for selecting products for new or renovated commercial and institutional buildings verified to have been extracted or sourced in a responsible manner (and for which life cycle information is available), measured either as:

- Raw Material Source and Extraction Reporting (one point), for using at least 20 different permanently installed products (from at least five different manufacturers) with publicly released reports from their raw material suppliers meeting defined criteria – see LEED version 4 for details; or
- Leadership Extraction Practices (one point), for using products meeting at least one of the responsible extraction criteria below for at least 25 percent, by cost, of the total value of permanently installed building products in the project:
 - Recycled content – Product content calculated as the sum of postconsumer recycled content plus half the pre-consumer recycled content, based on cost;
 - Materials reuse – Products salvaged, refurbished, or reused;
 - Extended Producer Responsibility (EPR) – Products purchased from a manufacturer (producer) participating in an EPR program or directly responsible for extended producer responsibility;
 - Bio-based materials – Products meeting Sustainable Agriculture Network's Sustainable Agriculture Standard;
 - Wood products – Products certified by the Forest Stewardship Council or USGBC-approved equivalent;
 - Other USGBC approved program for leadership extraction criteria.

Recycled Content, Reduced Impact Materials

ASHRAE Provision 9.4.1.1 and 9.4.1.2

Promotes codes for new or renovated buildings, as well as new systems and equipment in existing buildings, mandating permanently installed materials have a minimum of 10 percent recycled content based on cost of the total materials in the building project. (The recycled content of a material shall be the postconsumer recycled content plus one half of the pre-consumer recycled content, determined by weight [mass]. The recycled fraction of the material in a product or an assembly shall then be multiplied by the cost of the product or assembly to determine its contribution to the 10 percent requirement.)



Green and Healthy Buildings: Copper Applications

As described above, the 128 different applications of copper found in commercial buildings can make them greener and healthier and can contribute to the 420+ credits, features and provisions awarded within LEED version 4, WELL version 1 and ASHRAE 189.1. In fact, one-third of these credits can be either directly or indirectly met via specification of one of the copper applications provided in the complete list below.

Architecture (exterior, structural)

Facades
 Wall cladding
 Rain screens
 Curtain walls
 Copper alloy light fixtures
 Window frames
 Roofing
 Building expansion joints
 Flashing
 Gutters and discharge scupper
 Downspouts
 Roof drains
 Floor drains
 Drain flanges
 Elevators
 Escalators
 Exterior railing systems
 Fountains
 Statuary
 Ornamental
 Landscaping
 Tubing (to move medical gases)
 Fenestrations and openings
 (e.g., windows and entrances)

Building System Controls

Control panel for building
 plumbing systems
 Low voltage system controls
 Lighting system control panel
 Air system controls
 Emergency system controls
 A/V system controls
 Control panels for building
 mechanical systems
 Communications system controls
 Security system controls
 Control panel for fire and
 smoke suppression systems
 Water / plumbing system
 controls, including water meters

Interiors

Elevators
 Interior railing systems
 Interior wall cladding
 Doors
 Ceiling tiles
 Locks, locksets, closers
 Keyboards, mouse covers
 Soap dispensers
 Sinks
 Showers, tubs
 Drinking fountains
 Bottle filling stations
 Flush valves
 Access controls
 Light fixtures
 Furnishings
 Range hoods
 Wall tiles
 Table tops, counter tops
 Art, decorative
 Door push plates, kick plates
 Hydrotherapy tanks
 Carts (table, legs, handles)
 Floor tiles
 Chair armrests, frames
 Exercise equipment,
 handles, bars
 Hardware (hinges, door pulls)
 Assistance railings (e.g., beds,
 toilets, stairs)
 Hospital furniture (e.g., beds,
 bedside tables)
 Plumbing fixtures (water in)
 and fittings (waste out)
 Kitchen design elements
 (backsplash, cabinet doors,
 hinges, pulls)

Plumbing (fluid movement)

Piping
 Gas distribution
 Downspouts
 Flashing
 Gutters
 Faucets and fixtures
 Toilet and urinal hardware
 Drainage systems
 Drain waste heat recovery
 Drain covers / drain plates
 Floor drain strainers
 Drains and flanges
 Fire suppression
 Sprinklers
 Pressure reducing stations
 Thermostatic mixing valves
 On-demand water heaters
 Water heaters /
 hot water equipment
 Temperature modulating stations

Energy Generation and Storage

Photovoltaics
 Wind energy
 Solar thermal
 Thermal energy storage
 Direct exchange heat pumps
 Heat exchangers
 Gas distribution systems
 Waste water
 Battery for electrical
 energy storage
 Battery storage (interconnect
 electric vehicles, supply
 several buildings)
 Geothermal heating systems/
 direct exchange systems
 Thermal energy storage (e.g.,
 ice, chemical)

Mechanical Systems and Appliances

AC equipment
 Motor driven systems
 Heating equipment
 Refrigeration equipment
 Printed circuit boards
 Computers
 Gas combustion equipment
 Boilers for heating
 Hand dryers
 Cooling towers

Electrical Systems

Wiring
 Cables
 Motors
 Microcircuits
 Electric vehicle charging
 Satellite dishes
 Radiant flooring
 Lightning protection
 Transformers
 Power quality monitoring
 Receptacles with USB ports
 Smart lighting controls
 Building power circuits
 Lighting circuits
 Data / signal transmission and
 telecommunications
 Individual / point of use
 lighting controls
 Electronic lighting
 management
 Automated water controls
 (auto flush, auto faucets)
 Earthing systems
 (grounding and bonding)
 Generators
 (incl. backup generators)
 Electronic thermal
 management
 Security cameras retina
 scanners, fingerprint readers

For more information, please contact:

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