BEYOND SMART CITIES

# CERTIFIED SUSTAINABLE DEVELOPMENT PROFESSIONAL AEE CSDP EXAM

236+ key terminology flash cards!

SUSTAINABILITY SPECIALIST
BEYOND SMART CITIES

# CSDP FLASH CARDS

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| **Absorption Chiller** | A refrigeration machine that uses heat as the power input to generate chilled water. |
| **Actual Demand** | The amount of kW demand registered on the electric meter during the billing cycle. |

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| **AFUE** | Annual Fuel Utilization Efficiency. |
| **Air Handling Unit (AHU)** | Draws return air from the conditioned space, mixes it with outside air, filters it, adds or withdraws heat, and returns it to the conditioned space. Normally comprised of a fan, cooling or heating coils, and filters. |

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| **Ambient Temperature** | Normally, the temperature outside, or the temperature of air surrounding a building. Also refers to the temperature of the immediate surrounding environment of a device. |
| **Ancillary** | Miscellaneous energy-consuming equipment. |

**ASHRAE**

American Society of Heating, Refrigerating, and Air Conditioning Engineers

**Atmospheric Burner**

A burner in combustion furnaces or boilers that works on atmospheric pressure only, unassisted by induction or forced draft fans.

## Average Occupancy

The average number of people in a building or area over a 24-hour period.

## Balance Point Temperature

The outside temperature when there is no heating or cooling is required (thermally neutral). The point at which the internal heat gains of a building from lighting, people, and machines, etc. equals the losses through walls, roofs, and windows.

## Ballast

A device is used with fluorescent and HID lamps to obtain the necessary starting and operating circuit conditions by modifying the incoming voltage and current.

## Balance Point Temperature

The outside temperature when there is no heating or cooling is required (thermally neutral). The point at which the internal heat gains of a building from lighting, people, and machines, etc. equals the losses through walls, roofs, and windows.

## Base Load

Energy requirements of a facility that are unaffected by weather. The minimum amount of electricity or natural gas livered or required over a given period of time at a steady rate.

## Baseline

Energy consumption or costs for a specified time period to which future usage or costs are compared.

## Billing Cycle

The regular periodic interval used by a utility for reading the meters of customers for billing purposes.

## Authority having jurisdiction (AHJ)

The agency or agent responsible for enforcing this standard.

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| **Base case** | An operating scenario prior to consideration of energy efficiency measures (EEMs); used as a reference for evaluation of subject EEMs. |
| **Building energy** | Energy consumed by a building as measured at the boundaries of the building |

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| **Building energy model** | First-principles engineering model that provides energy-using building system information (heating, ventilation, and air conditioning; lighting; occupancy; plug loads; building envelope). The model and weather data feed a computer building energy simulation program. The computer simulation program estimates building energy use and demand for a time interval specified in the building energy model. Simulation programs produce different outputs depending on their setup. |
| **Combined heat and power (CHP)** | The agency or agent responsible for enforcing this standard. |

## Distributed energy resource (DER)

The onsite production of electric power by any of a variety of technologies; may also include energy storage technologies.

## Energy cost

The total cost for energy supplied to a building or building site, including such charges as base, demand, customer, power factor, and miscellaneous, such as sales taxes.

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| **Energy Cost Index (ECI)** | The total annual energy cost for the building divided by the gross floor area. |
| **Energy efficiency measure (EEM)** | An action taken in the operation or equipment in a building that reduces energy use of the building while maintaining or enhancing the building's safety, comfort, and functionality; also referred to as "energy conservation measure" (ECM). |

## Energy use intensity (EUI)

Total annual building energy use divided by the gross floor area. The EUI may be expressed as a site energy EUI or a building energy EUI.

## Gross floor area

The sum of all building floor areas without deductions for floor penetrations other than atria. Covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, roof overhangs, parking garages, surface parking, and similar features are excluded from its measurement.

## Interactive effect

The change in resultant energy savings estimates or actual energy savings due to analyzing or implementing multiple EEMs that impact one another.

## Life-cycle cost analysis

A general approach to economic eval- uation that encompasses several related economic evaluation measures, including life-cycle cost (LCC), net benefits (NB) or net savings (NS), savings-to-investment ratio (SIR), net present value (NPV), and adjusted internal rate of return (AIRR), all of which take into account all dollar costs related to owning, operating, maintaining, and disposing of a project over the appropriate study period.

**Model**

Mathematical representation or calculation procedure used to estimate the energy used in a building or facility. Models may be based on equations that specifically represent the physical processes.

**Practical measure**

An EEM that is determined to be technically feasible.

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| **Owner's criteria** | A set of criteria determined through communication between the owner or owner's representative and the qualified energy auditor by which recommendations and findings are evaluated. |
| **Qualified energy auditor** | An energy solutions professional who assesses building systems and site conditions; analyzes and evaluates equipment and energy use; and recommends strategies to optimize building resource use. |

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| **Renewable energy resource** | A non fossilfuel energy source such as solar, wind, or geothermal energy. For purposes of this standard, consideration is to onsite opportunities for use of such sources. |
| **Simple payback** | Estimated initial EEM cost divided by the EEM first-year calculated cost savings. Both savings and costs are in dollars ($) or other consistent monetary units, and the simple payback is expressed in years. |

## Simple return on investment (simple ROI )

The EEM first- year calculated cost savings divided by estimated initial EEM cost. Both savings and costs are in dollars ($) or other consis- tent monetary units.

## Site energy

Energy consumed by a building as measured at the boundaries of the building site Esite. Site energy use is the sum of annual electric use in kWh (converted to kBtu or MJ) and all other annual energy use (in kBtu or MJ). It includes fuel used for any onsite generation but not the output of that generation. Site energy use is net of onsite generation such as solar or wind.

## Block Rate Schedule

Rate schedule that provides different unit charges for various blocks of demand or energy.

## Blowdown

Discharge of water from a boiler or cooling tower sump to control level of dissolved solids. May be continuous or cyclic.

## Boiler Capacity

Rate of heat output in Btu/h measured at the boiler outlet at the design pressure and/or temperature.

## Boiler Economiser

The term "economiser" is sometimes applied to a boiler device that recovers heat from the exhaust stack to preheat the feed water.

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| **Btu** | British thermal unit. A standard unit for measuring the quantity of heat energy equal to the quantity of heat required to raise the temperature of 1 pound of water by 1 Fahrenheit (from 59°F to 60°F) at sea level. |
| **Btu/h** | British thermal units per hour. Many aspects of a building, heat load calculations, and HVAC systems are expressed in terms of how many Btus are transferred in a one hour period. |

## Building Envelope

The external surfaces of a building including the roof, walls, windows, floor, which separate the conditioned space from the external ambient environment.

## Capacitor

Electrical appliance working on the condenser principle.Two conducting plates are separated by an insulating layer. When alternating current is applied, the capacitor is adjusted so that its leading current balances the lag of the circuit giving a high-power factor.

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| **Capital Cost** | The total investment needed to complete a project and bring it to a operable status. |
| **CDD (Cooling Degree Day)** | The difference of the mean daily temperature above a base temperature of 65°F. |

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| **Celsius (C)** | A thermometric scale in which the melting point of ice is zero degrees and the boiling point of water is 100 degrees above zero (°C = [°F-32] 5 /9). |
| **CFM (Cubic feet per minute)** | A measurement of a volume of air movement over time |

## Chiller

A central plant refrigeration device that produces chilled water for use in cooling coils.

## Cogeneration

Generating electricity using a waste heat fuel source (full or partial) which comes from another industrial process.

## Coil

A cooling or heating element made of pipe or tubing.

## Color Rendering Index (CRI)

A measure of the degree of color shift objects undergo when illuminated by a light source as compared with the color of those same objects when illuminate by a reference source comparable color temperature. Based on a scale of 100.

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| **Conduction** | Heat transfer or transmission through a solid. |
| **Convection** | Heat transfer by the motion of a fluid or gas, usually air. |

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| **Cooling Tower** | The condensing unit of a central chiller plant which uses evaporation and air movement to provide cooling. |
| **COP (Coefficient of Performance)** | Ratio of heat produced (including circulating fan heat but not supplemental or backup heat) divided by the total electric energy input (Btus) including condenser fan and defrost. |

## Damper

A device used to vary the volume of air passing through and air outlet, inlet, or duct.

## Daylighting

Using natural light through windows and skylights. Ideally used in conjunction with dimming controls to reduce amount of electrical light input to maintain constant lighting levels.

## DDC (Direct Digital Control)

Usually refers to a computer based control system that can evaluate several conditions and provide a more complex response than a simple solid-state control. It is often referred to as a "distributed control unit" of a larger computerized system to provide localized control independently of the main data storage and analysis system.

## Deadband

In a thermostat, the difference in degrees between the point where heating shuts off and the cooling mode comes on.

## Capital Cost

The difference between the average daily temperature (°F) and a standard temperature of 65°F. Degree days are used to indicate patterns of deviation from a given temperature standard. Average daily temperatures above 65°F are cooling degree days and average daily temperatures below 65°F are heating degree days.

## Dekatherm

The quantity of heat energy which is equivalent to one million (1,000,000) Btus.

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| **Demand** | The average rate of electrical energy usage over a specified period of time, usually 15 or 30 minutes. Measured in kilowatts (kW). |
| **Demand Limiting** | A technique to reduce demand by measuring in- coming electrical power and turning off specified loads to keep the rate of electrical usage under a preset level. |

## District Heating

A system that involves the central production of hot water, steam, or chilled water and the distribution of these transfer media to heat or cool buildings. Steam or hot water from an outside source used as an energy source in a building. The steam or hot water is produced in a central plant and piped into the building.The district heat may be purchased from a utility or provided by a physical plant in a separate building that is part of the same facility, such as a hospital complex or university

## Duty Cycling

A method of reducing peak demand and energy consumption by cycling motors in a lead/lag fashion. It can reduce accumulated run times but may impact equipment life and maintenance by frequent starts.

**DX (Direct Expansion)**

A system designed to recover energy from an exhaust air stream and utilize the energy for another purpose such as preheating ventilation air or domestic hot water.

**ECM (Energy Conservation Measure)**

A building modification or equipment change to reduce energy consumption. Usually refers to a capital improvement project with a payback longer than one or two years.

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| **Economizer Cycle** | A method of operating a ventilation system to reduce refrigeration load. Whenever the outdoor air conditions are more favourable (lower heat content) that return air conditions, outdoor air quantity is increased to provide "free" cooling. |
| **ECO (Energy Conservation Opportunity)** | Usually refers to opportunity to save energy through implementation of and operation and maintenance O&M measure or installation of an energy conservation measure (ECM). |

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| **EMCS (Energy Management Control System)** | Some type of computer based control system whose primary function is the control of energy using equipment to reduce the amount of energy consumed |
| **Efficacy** | The luminous efficiency of a lamp expressed as the ratio of total lumens produced to the watts consumed. |

## Efficiency

The ratio of the useful energy (at the point of use) to the thermal energy input for a designated time period, expressed in percent.

## Emissions

Waste substances released into the air or water.

## End-use Sectors

The residential, commercial, industrial, and transportation sectors of the economy.

## Energy

The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. Electrical energy is usually measured in kilowatt-hours, while heat energy is usually measured in Btus.

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| **Energy Accounting** | A formal process of providing long term organization and monitoring of utility costs and consumption data for a facility. |
| **Energy Audit** | An assessment of the energy flows in a building or process, usually with a view to identify opportunities to reduce consumption. |

## Energy Balance

The accounting of energy inputs and outputs in any process.

## Energy Charge

That portion of the charge for electric service based upon the electric energy (kWh) consumed or billed.

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| **Energy Consumption** | The use of energy as a source of heat or power or as an input in the manufacturing process. |
| **Energy Content** | The intrinsic energy of a substance, whether as gas, liquid, or solid, in an environment of given pressure and temperature. |

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| **Energy Use Index** | A representation of annual energy usage per square foot of a facility. May appear in any basic or common unit such as Btu, kWh, or therms per square foot per year. |
| **ESCO (Energy Service Company)** | A company that offers to reduce a client's energy consumption with the cost savings being split with the company to pay for installation costs of energy conservation measures. |

## Evaporator

A heat exchanger which adds heat to a liquid changing it to a gaseous state. In a refrigeration system, it is the component which absorbs heat.

## Excess Air

Air which passes through an appliance and the appliance flues in excess of that which is required for complete combustion of the gas. Usually expressed as a percentage of the air required for complete combustion of the gas.

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| **Exfiltration** | Air leakage out of the building. |
| **Exhaust Air** | Air removed from the conditioned space to the outdoors by a dedicated exhaust fan or by the ventilation system. |

## Fahrenheit

A thermometric scale in which the melting point of ice is 32° above zero and the boiling point of water is 212° above zero (°F = 9/5 °C + 32).

## Firm Service

Gas of electric service offered to customers under schedules or contracts which anticipate no interruptions, even under adverse conditions.

## Fixture

A complete lighting unit, or luminaire, consisting of one or more lamps, ballast if needed, and elements necessary to position and protect lamps, distribute light, and connect to a power supply

## Flue

The exhaust stack of a combustion boiler or other combustion.A device to convey products of combustion to the outside.

## Fluorescent Lamp

Low-pressure electric discharge lamp in which a phosphor coating transforms some of the ultraviolet energy generated by the discharge into light.

## Foot-candle

Measure of luminance or light. The illumination of one lumen uniformly distributed on a one foot square surface

## Forced Draft

A fan on the intake side of a combustion furnace or boiler burner that forces combustion air into the burner.

## Generator

A machine that converts mechanical energy into electrical energy.

## Glare

Any excessive brightness from a direct or reflected source that annoys, distracts, or reduces visibility.

## HDD (Heating Degree Day)

The difference of the mean daily temperature below a base temperature of 65°F. A relative measure of how weather imposes a heating load on a building which assumes that the building will not require heating until the outdoor temperature drops below 65°F.

## Heat Pump

A DX cooling system that can operate in the reverse mode and be used as a heating unit as well as a cooling unit.

## HID (High Intensity Discharge)

High intensity discharge lighting including mercury vapor, metal halide, and high pressure sodium light sources. Light is produced by a high pressure gas discharge at high temperatures requiring protective sealed arc tubes.

**Horsepower (HP)**

A unit of power where 1 horsepower equals 746 watts or 42.4 Btu per minute. HVAC (Heating, Ventilation, and Air-Conditioning)-A system that provides the process of comfort heating, ventilating, and/or air conditioning within a building.

**Hydronic System**

A heating and/ or cooling system that uses a liquid, usually water, as the medium for heat transfer.

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| **IES** | Illuminating Engineering Society Illuminance-Lighting level measured in foot-candles or lux on a work- ing surface such as a desktop or floor. |
| **Induced Draft** | A fan on the flue side of the burner which draws combustion air into the combustion chamber through negative air pressure. |

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| **Industrial Sector** | The industrial sector is generally defined as manu-facturers who are primarily engaged in a process which creates or changes raw or unfinished materials into another form or product. |
| **Infiltration** | The process by which outdoor air leaks into a building through cracks and holes in the building envelope. |

## Inlet Vanes

Damper vanes located at the intake of a fan to reduce the total air flow (CFM) the fan will produce.

## Interruptible Service

Low priority service offered to customers under schedules or contracts which anticipate and permit interruption on short notice, generally in peak-load seasons, by reason of the claim of firm service customers and higher priority users. Gas is available at any time of the year if the supply is sufficient and the supply system is adequate.

## KVAR (Kilovolt Amperes Reactive)

The unit used to express reactive power. VARs are the reactive component of VA (Apparent Power), caused by a phase shift between AC current and voltage in inductors (coils) and capacitors. In inductors, current lags voltage (in time), while in capacitors, current leads voltage. VARs are typically first present in a distribution system as a result of inductive loads such as motors, reactors and transformers. VARs are then used in sizing power factor correction capacitors, which are used to offset the effects of these inductive loads. VARs represent the magnetising energy in loads such as induction motors.

## kW (kilowatt)

Active power, also known as Real/True Power. Watts measure that portion of electrical power which does work. Kilo is from the metric system and means 1,000.

**kWh (kilowatt hour)**

A unit of electrical energy equivalent of 1000 watts of power provided for one hour. One kWh equals 3,413 Btus.

**Lamp**

A light source, commonly called a bulb or tube.

## Lighting Power Budget

The total amount of power that may be utilized by a lighting system in a given space or building.

## Load

The amount of demand or required energy to satisfy the need of any system.

**Lumen**

A measure of the quantity of light produced by a light source.

**Make-up Air**

Outdoor air supplied to a building to compensate for air exhausted from the building.

## Make-up Water

Water supplied to a system to replace water lost by blowdown, leakage, and evaporation.

## Mixed Air

Mixture of return air and outside air before it has been conditioned.

## Nameplate Rating

The full-load continuous rating of a piece of equipment under specified conditions as designated by the manufacturer, and written on the nameplate.

## Night Cycle

Also referred to as the unoccupied cycle. A unique cycle of an HVAC control system that distinguishes between occupied and unoccupied operation. A common night cycle mode may include closing of outside air dampers, lowering of space temperatures, and reduced fan operation.

## Night Setback

A different set-point during the night or unoccupied periods.

## O&Ms (Operation and Maintenance Measures)

Low cost or no cost energy efficiency opportunities involving changes in the operation and maintenance practices taken to improve equipment or building efficiency.

## Occupied Hours

The time when a commercial, industrial, or institutional building is normally occupied by people functioning in their jobs.

## Off-peak

Generally refers to designated periods of relatively low system demand. NERC has defined these periods as 10 p.m. until a.m., Monday through Saturday and all day Sunday.

## On-peak

The time of day and week when demand for electricity in a region is high.

## Outside Air

Air taken from the outdoors and therefore not previously circulated through the HVAC system.

## Payback Period

The length of time necessary to recover the initial investment of a project through energy or maintenance savings.

## Peak Load or Peak Demand

The electric load that corresponds to a maximum level of electric demand in a specified time period

**Plenum**

A large duct or area above a dropped ceiling used to distribute conditioned air or collect return air from a conditioned space.

**Power**

The rate at which energy is transferred. Electrical energy is usually measured in watts. Also used for a measurement of capacity

## Power Factor

The ratio of real power to apparent power, kW/kVA Devices that need an electromagnetic field to operate, such as motors and fluorescent lighting ballasts, tend to lower the power factor within a facility. Many utilities impose cost penalties for low power factor. Low power factors can be corrected by installing power capacitors or by other measures.

## Predictive Maintenance

Using historical maintenance and breakdown information to forecast or predict when a particular piece of equipment will need to be rebuild or replaced.

## Present Value

The present worth of a dollar saved or spent at a determined point of time in the future. This concept reflects the time value of money.

## Preventive Maintenance (PM)

A system of prescheduling adjustment, cleaning, calibration, lubrication, component replacement, repairs or whatever is necessary to eliminate minor equipment problems before they become major.

## Radiation

The transfer of heat from one body to another by heat waves without heating the air between the bodies.

## Ratchet Clause

A clause in the rate schedule of some electric utilities that bases a customer's demand charges on a specified percentage of the highest kW Demand usage during the proceeding eleven months.

## Rate Schedule

The rates and conditions set by the utility for the use of electricity and natural gas.

## Reactive Power

Power used by induction motors and transformers to excite magnetic fields. Measured in kVARs (kilovolt amperes reactive).

## Real-time Pricing

The pricing of electricity based on the actual (as opposed to forecast) prices which fluctuate many times a day and are weather-sensitive, rather than varying with a fixed schedule(such as time-of-use pricing).

## Reheat

The application of sensible heat to supply air that has been previously cooled below the temperature of the conditioned space by mechanical refrigeration or the introduction of outdoor air to provide cooling or ventilation.

## Remedial Maintenance

Troubleshooting or making repairs as break- downs occur.

## Residential Sector

The residential sector is defined as private house-hold establishments that consume energy primarily for space heating, water heating, air conditioning, lighting, refrigeration, cooking, and clothes drying. Apartment houses are also included.

## Retrofit

The addition or replacement of equipment or alteration of an existing building to make it more energy efficient.

## Return Air

Air that is drawn back into the ventilation system from the conditioned space.

## R-Value

Term used to measure a given thickness of an insulating material's resistance to the flow of heat.

## Seasonal Loads

Energy loads that vary seasonally due to such factors as changes in weather, operation, or other seasonal occupancy variations.

## Sensible Heat

The heat which, when added or subtracted, causes temperature change.

## Simple Payback

The length of time required for an investment to pay for itself determined by dividing the initial investment by the annual savings.

## Visual Task

Those details and objects which must bee seen for the performance of a given activity, including the immediate background of details or objects.

## Visible Spectrum

The range of light waves detectable by human eyes.

## Watt

A unit of power which is the rate of energy either produced or used. The rate of energy transfer equivalent to 1 ampere flowing under a pressure of 1 volt at unity power factor. One watt equals 3.413 Btu/h.

## Work Plane

Plane at which work is usually performed and at which illumination is specified and measured. Unless otherwise indicated, the work plane is assumed to be a horizontal plane 30 inches above the floor.

## Zone

A space or group of spaces within a building with heating and / or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

## Supply Air

Conditioned air going to a conditioned space. The end product of the HVAC system

## Tariff

A document, approved by the responsible regulatory agency, listing the terms and conditions, including a schedule of prices, under which utility services will be provided.

## Task Lighting

Lighting directed to a specific surface or area used for performing individual tasks.

## Thermostat

A temperature sensitive device that turns heating and cooling equipment on and off at a set temperature.

## Time-of-day Metering

A method of measuring and recording a customer's use of electricity by the time of day it was consumed.Generally used to establish maximum demand for specified periods of time for on-peak and off-peak energy charges.

## Tons of Cooling

A way of expressing cooling capacity or how much heat the equipment can remove from the air. One ton of cooling equals 12,000 Btu/h.

## U-Value

The thermal transmittance or overall coefficient of heat trans- mission expressed in Btus per square foot per hour per degree F.The lower the U-value, the less heat is transferred.

## Unoccupied Hours

The time when a commercial, industrial, or institutional building is normally empty of people, except for a few attendants or maintenance personnel.

## Useful Life

That period of time for which a modification used under specific conditions is able to fulfill its intended function and which does not exceed the period of remaining use of the building being modified.

## Ventilation

Usually refers to the introduction of outdoor air into a building to replace exhaust air and air exfiltration.-Changing the air in an enclosed space by removing the existing air and replacing it with air introduced from another environment, usually the outdoors.

## VAV (Variable Air Volume)

Air flow is varied to match the heating or cooling loads.

## Energy sub-metering

The measurement and billing of energy consumption for individual suites in a multiunit building or provide sep- arate meters on all major uses in the building, including chillers, car parks, air-handling fans, lifts and common area light and power

## Energy security

In countries with economies based on exported oil and gas, the larger concern is security of demand, a demand with little changes

## Green buildings

Buildings that are environmentally responsible and resource-efficient throughout, from siting to design, construction, operation, maintenance, renovation and deconstruction.

## Ergonomic

A type of science that makes use of the correct equipment design in the workplace, this is used to maximize productivity in the workplaceExcited

## Greenhouse gas emissions

Gases that can absorb the solar radiation and trap it in the earth's atmosphere. These gases include car- bon dioxide, water vapor, methane, nitrous oxide and others

## Humidification

The artificial regulation of humidity in home environ- ments, industrial environments and health care applica- tions such as artificial respiration.

## Best practice

A technique or, in this case, operating methodology that has been proven to reliably lead to a desired result

## Building condition surveys

A method that will let you understand the general condition of a building, including all building defects.

**Diffuse radiation**

The sunlight that has been scattered by molecules and particles in the atmosphere but that has still made it down to the surface of the earth

**Displacement power factor**

The power factor due to the phase shift between voltage and current at the fundamental line

## Economizers

A piece of mechanical equipment that preserves heat to use it for other purposes like preheating the fluid.

## Energy security

In countries with economies based on exported oil and gas, the larger concern is security of demand, a demand with little changes

## Energy sub-metering

The measurement and billing of energy consumption for individual suites in a multiunit building or provide sep- arate meters on all major uses in the building, including chillers, car parks, air-handling fans, lifts and common area light and power

## Exfiltration

Uncontrolled outward air leakage from inside a build- ing, including leakage through cracks and interstices around windows and doors and through any other exte- rior partition or penetration

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| **Fossil fuel** | A natural fuel such as coal or gas, formed in the geological past from the remains of living organisms |
| **Green buildings** | Buildings that are environmentally responsible and resource-efficient throughout, from siting to design, construction, operation, maintenance, renovation and deconstruction. |

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| **Harmonic distortion** | The degree to which a waveform would deviate from the fundamental waveform |
| **Humidification** | The artificial regulation of humidity in home environ- ments, industrial environments and health care applica- tions such as artificial respiration. |

## Impulse steam turbine

Types of turbines consisting of fixed nozzles which are used to increase the velocity of the high-pressure steam.

## Industrial competitiveness

Different industries competing with one another relating to the supply and demand of the same product. In this case competing in terms of energy efficiency mechanisms

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| **Infiltration** | The entry of outside air into a building, which is similar to ventilation except that the entry of air with infiltration is unintentional or uncontrolled. |
| **Latent heat** | The change in heat content that occurs with a change in phase and without change in temperature |

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| **Latent heat of fusion** | The amount of heat produced to change a solid into a liquid with no change in temperature |
| **Latent heat of vaporization** | The input energy required to change the state from liquid to vapor at constant temperature |

## Load shedding

When there is not enough electricity to meet the demand and it is necessary to interrupt electricity supply in cer- tain areas

## Occupancy applications

Applications or control systems used to determine whether there are people in a particular space or not.

## Power factor

This is the ratio of the real power that is used to do work and the apparent power that is supplied to the electricity grid

## Psychrometric

A field interested in the thermal and physical properties of gas vapor mixtures

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| **Quantitative** | Describing something relating to a type of information or data that is based on quantities obtained, using a quantifiable measurement process |
| **Reaction steam turbine** | Types of turbines consisting of shaped rotor blade noz- zles to create a reaction which causes the turbine shaft to rotate. |

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| **Retrofit** | Install or fit (a device or system, for example) for use in or on an existing structure, especially an older dwelling |
| **Reverse cycle heat pumps** | A special heat pump that can draw heat from the out- door air and circulate it into your home during winter and in the summer, it reverses the process and draws heat from the inside air and releases it outdoors |

## R-value

A measure of the capacity of a material to resist heat transfer. The r-value is the reciprocal of the conductivity of a material (u-value). The larger the r-value of a mate-rial, the its insulating propenrties

## Sankey diagrams

Type of flow diagrams in which the width of the arrow is shown proportionally to the flow quantity used to visualise energy or material or cost transfers between processes.

## Sensible heat

Energy that jostles molecules and atoms in substances such as water. The more movement, the hotter the sub- stance becomes. Sensible energy gets its name from the fact that we can sense it, by touching the substance directly or indirectly with a thermometer of some type. It is the heat absorbed or released when a substance undergoes a change in temperature

## Smart technology

The simpler and easier ways of doing traditional things in a more effective and productive manner. For example, sending a text message rather than a letter through the post office to someone on urgent matters.

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| **Waste heat recovery** | The process of recovering waste heat (heat not used by a certain process) and using it elsewhere |
| **Wick** | A strip of porous material up which liquid fuel is drawn by capillary action to the flame in a candle, lamp, or lighter |

## Vital signs

Are measurements of the body's basic functions, the four basic vital signs are pulse rate, breathing rate, body temperature and blood pressure

## Voltage optimization

This is a term given when there is a controlled reduction in the voltage received by the consumer in order to reduce energy use and power demand

**Unity**

It refers to the power factor of 1,0 which is obtained when current and voltage are in phase

**U-value**

The overall heat transfer coefficient that describes how well a building element conducts heat or the rate of transfer of heat (in watts) through one square meter of a structure divided by the difference in temperature across the structure

**Sustainable development**

Development that meets the needs of the present with- out compromising the ability of future generations to meet their own needs

**Systems approach**

An approach used to analyze something as being a system and consisting of a set of parts related to one another.

**Thermal energy**

The energy developed through the use of heat energy; it is generated and measured by heat

**Thermal envelope**

Some form of insulation layer that controls heat flow out the building, is part of a building envelope but may be in a different location such as in a ceiling

## Thermal comfort

When you are happy with the temperature of your environment.

## Thermal processes

It refers to the process that takes place when a substance changes from one state to another; the steps or path between the initial and final thermodynamic states

**Thermocouple**

A thermoelectric device for measuring temperature, consisting of two wires of different metals connected at two points, a voltage being developed between the two junctions in proportion to the temperature difference

**Thermostat**

A device, as in a home heating system a refrigerator, or an air conditioner, that automatically responds to temperature changes and activates switches controlling the equipment

| | |
|---|---|
| **Adjusted performance indices** | Performance indices that are altered in order to take into account special end uses and conditions which differ from those in the benchmark. |
| **Delivered energy** | The energy purchased by the consumer that crosses the site boundary. |

| | |
|---|---|
| **Net floor area** | Agent's lettable area (i.e. gross area minus common areas and ancillary spaces) |
| **Normalised performance indices** | A total delivered energy per m2 performance indicator adjusted to take account of factors such as geographic location and hours of use to allow comparisons to be made between buildings |

## Performance indices

Performance indices, denominated in kW·h/$m^3$, kg of CO 2 emissions/$m^2$, or £/$m^2$, are metrics utilized to assess the energy and environmental performance of a structure. These indices enable comparisons with benchmarks, other structures, or annual monitoring of the building in question.

## Special end uses

End uses additional to those which make up the delivered energy consumption yardstick for a building.

## Treated floor area

Gross area less plant rooms and other areas (e.g. stores, covered car parking and roof spaces) that are not directly heated

## Yardstick

Representative value of a parameter, for a category of building (possibly with a specified quality or efficiency level) against which an individual building performance indicator or index is compared (synonymous with Benchmark)

## Energy Efficiency

Energy efficiency is a fundamental principle in high-performance building design. It refers to the use of technology and design strategies to reduce energy consumption and minimize waste. For example, using energy-efficient lighting fixtures, insulation, and HVAC systems can help reduce a building's energy usage and lower operating costs.

## Passive design

Passive design uses natural elements like sunlight, ventilation, and thermal mass to regulate temperature and lighting in buildings, creating comfortable, energy-efficient spaces without relying on mechanical systems.

## Renewable Energy

Renewable energy sources like solar panels, wind turbines, and geothermal systems are crucial in high-performance building design, reducing reliance on fossil fuels and minimizing environmental impact.

## Building Envelope

The building envelope, comprising exterior elements like walls, windows, doors, and roof, is crucial for thermal comfort, air leakage prevention, and energy loss reduction.

## Life Cycle Assessment

Life Cycle Assessment (LCA) evaluates a building's environmental impact from construction to demolition, considering materials, energy use, and waste generation, enabling designers to minimize carbon footprint.

## Green Building Certification

Green building certification programs like LEED and BREEAM acknowledge buildings meeting sustainability criteria, demonstrating environmental responsibility and potentially increasing a building's market value.

## High Performance Building Design

High performance building design is a holistic approach focusing on sustainability, energy efficiency, and occupant well-being. It involves integrating various parameters to create sustainable, energy-efficient, and environmentally friendly buildings, with architects responsible for ensuring these attributes are met.

## Passive Design Strategies

Passive design strategies utilize natural elements like sun, wind, and shade to enhance energy efficiency and create a comfortable indoor environment, reducing artificial lighting and solar heat gain.

## Energy-Efficient Systems

Energy-efficient systems, including high-performance HVAC, lighting controls, and renewable energy sources, significantly reduce a building's energy consumption and carbon footprint.

## Sustainable Materials

Sustainable materials, like recycled steel and bamboo, are crucial for high-performance building design, promoting a circular economy and improving indoor air quality and occupant health.

## Building Envelope Design

Building envelope design, including walls, roof, windows, and doors, regulates thermal comfort and energy efficiency. Advanced insulation materials, air barriers, and high-performance glazing minimize heat loss, reducing costs.

## Energy informatics

Energy informatics utilizes advanced technologies like artificial intelligence, machine learning, and big data analytics to optimize energy consumption, improve efficiency, and reduce costs in energy-related processes.

## Smart buildings

Smart buildings use advanced technologies to monitor and control HVAC systems, enhancing energy efficiency and occupant comfort. They use sensors, actuators, and communication networks for real-time data collection and analysis.

## Smart grid integration

Smart grid integration integrates digital technologies into traditional electrical grids for improved reliability, efficiency, and sustainability. It allows bidirectional communication between utilities, consumers, and distributed energy resources, enabling dynamic energy supply and demand adjustments.

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