

# Energy System Terminology

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*Air Handling Unit (AHU)* – A central unit consisting of a blower, heating and cooling elements, filter racks or chamber, dampers, humidifier, and other central equipment in direct contact with the airflow. This does not include the ductwork through the building.

*Active solar* – As an energy source, energy from the sun collected and stored using mechanical pumps or fans to circulate heat-laden fluids or air between solar collectors and a building.

*Alternative-rate Energy Efficiency program assistance* – An Energy Efficiency (demand-side management) program assistance that offers special rate structures or discounts on the consumer's monthly electric bill in exchange for participation in Energy Efficiency programs aimed at cutting peak demands or changing load shape. These rates are intended to reduce consumer bills and shift hours of operation of equipment from on-peak to off-peak periods through the application of time-differentiated rates. For example, utilities often pay consumers several dollars a month (refund on their monthly electric bill) for participation in a load control program. Large commercial and industrial customers sometimes obtain interruptible rates, which provide a discount in return for the consumer's agreement to cut electric loads upon request from the utility (usually during critical periods, such as summer afternoons when the system demand approaches the utility's generating capability).

*ASHRAE Bin temperature data* – Temperature frequency in 5 F intervals available from American Society of Heating, Refrigerating and Air-Conditioning Engineers.

*Boiler* – A device for generating steam for power, processing, or heating purposes; or hot water for heating purposes or hot water supply. Heat from an external combustion source is transmitted to a fluid contained within the tubes found in the boiler shell. This fluid is delivered to an end-use at a desired pressure, temperature, and quality.

*British Thermal Unit (Btu)* – The amount of heat required to raise the temperature of one pound of water 1 degree Fahrenheit. The Btu is a small amount of heat equivalent to the heat released by a burning matchstick. For district heating systems, heat is often measured in million Btus (MMBtu) which is equivalent to one million Btu's.

*Building Commissioning* - a building performance quality assurance process that begins during design and continues through construction, occupancy, and operations. Commissioning ensures that the new building operates initially as intended by design and that building staff are prepared to operate and maintain its systems and equipment.

*Capacity* – The maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, adjusted for ambient conditions.

*Chiller* – Any centrally located air conditioning system that produces chilled water in order to cool air. The chilled water or cold air is then distributed throughout the building, using pipes or air ducts or both. These systems are also commonly known as "central chillers," "centrifugal chillers," "reciprocating chillers," or "absorption chillers." Chillers are generally located in or just outside the building they serve. Buildings receiving district chilled water are served by chillers located at central physical plants.

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*Chilled Water* – The product of a Chiller that is distributed through a building or, in the case of a District Cooling system, other adjacent buildings for the purposes of air conditioning.

*Coefficient of Performance (COP)* – Ratio of work or useful output to the amount of work or energy input, both represented in the same unit. Used generally as a measure of the energy-efficiency of chillers and heat pumps.

*Combined Heating and Power (CHP)* – A plant designed to produce both heat and electricity from a single heat source.

*Conservation* – A reduction in energy consumption that corresponds with a reduction in service demand. Service demand can include buildings-sector end uses such as lighting, refrigeration, and heating; industrial processes; or vehicle transportation. Unlike energy efficiency, which is typically a technological measure, conservation is better associated with behavior. Examples of conservation include adjusting the thermostat to reduce the output of a heating unit, using occupancy sensors that turn off lights or appliances, and car-pooling.

*Constant Air Volume (CAV)* – A system designed to provide a constant air flow. This term is applied to HVAC systems that have variable supply-air temperature but constant air flow rates. Most residential forced-air systems are small CAV systems with on/off control.

*Consumer (energy)* – Any individually metered dwelling, building, establishment, or location using natural gas, synthetic natural gas, and/or mixtures of natural and supplemental gas for feedstock or as fuel for any purpose other than in oil or gas lease operations; natural gas treating or processing plants; or pipeline, distribution, or storage compressors.

*Cooling Degree Days* – A degree day is the difference in temperature between the outdoor mean temperature over a 24-hour day and a given base temperature. Cooling degree days occur when the outdoor mean temperature is above 65 F.

*Cubic Feet per Minute (CFM)* – A common means of assigning quantitative values to volumes of air or fluid in transit.

*Customer conversion* – The equipment in a customer building mechanical room that transfers thermal energy from the district heating system to the building systems to allow the heat to be distributed throughout the building. The customer conversion usually consists of heat exchangers, pumps, piping, control sensors, and control valves to enable heat to be efficiently transferred from the higher temperature district heating system to the lower temperature building system.

*Daylighting* – Designing buildings to maximize the use of natural daylight to reduce the need for electricity.

*Demand-Side Management (Energy Efficiency)* – A utility action that reduces or curtails end-use equipment or processes. Energy Efficiency is often used in order to reduce customer load during peak demand and/or in times of supply constraint. Energy Efficiency includes programs that are focused, deep, and immediate such as the brief curtailment of energy-intensive processes used by a utility's most demanding industrial customers, and programs that are broad, shallow, and less immediate such as the promotion of energy-efficient equipment in residential and commercial sectors.

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*Demand-side management costs* – The costs incurred by the utility to achieve the capacity and energy savings from the Demand-Side Management Program.

*Differential temperature (dT, delta T)* – The difference between the supply temperature and return temperature of the district heating water delivered to users. This is an indication of the amount of energy delivered to the customer.

*Distributed Control System (DCS)* – A control system of an energy production plant and process wherein control elements are not only located in central location but are also distributed throughout the system with each component sub-system controlled by one or more controllers so the intelligence is distributed across the sections of the system.

*Distribution* – The delivery of energy to retail customers.

*District energy* – A thermal energy delivery system that connects energy users with a central production facility.

*Diversified load* – The actual peak load on an energy system. The diversified load is less than the sum of the peak loads of individual users due to the difference in time of day that each individual user realizes their peak load.

*Distribution system* – The underground piping network that delivers hot water from an energy production facility to the customer buildings. Hot water is circulated through this distribution system using pumps that are located at the production facility.

*Domestic hot water* – Potable water that is heated for use in faucets, showers, laundry, and similar uses.

*Energy Conservation Measure (ECM)* – This includes building shell conservation measures, HVAC conservation measures, lighting conservation measures, any conservation measures, and other conservation measures incorporated by the building. However, this category does not include any Energy Efficiency program participation by the building. Any Energy Efficiency program participation is included in the Energy Efficiency Programs.

*Energy Transfer Station* – Equipment installed at the point of customer connection to the district energy system. The energy transfer station is utilized to transfer and measure the thermal energy delivered from the district energy distribution network to the customer's building(s) or other thermal loads.

*Energy Usage Intensity* - The quantity of total energy that a building consumes per square foot per year. Energy is usually expressed in terms of thousand British thermal units (KBtu/SF/year).

*Energy Utilization Index (EUI)* – Measure of the total energy consumed in cooling or heating of a building or facility in a period, expressed as British thermal unit (Btu) per (cooled or heated) gross square foot.

*Equivalent Full Load Hours* – Annual energy usage divided by the peak capacity used.

*Fixed Operations and Maintenance (FOM)* – Costs other than those associated with capital investment that do not vary with the operation, such as maintenance and payroll.

*Fuel Cell CHP* – Electrochemical power generation process generating both electricity and thermal energy suitable for making steam or hot water.

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*Geothermal energy* – Hot water or steam extracted from geothermal reservoirs in the earth's crust. Water or steam extracted from geothermal reservoirs can be used for geothermal heat pumps, water heating, or electricity generation.

*Geothermal plant* – A plant in which the prime mover is a steam turbine. The turbine is driven either by steam produced from hot water or by natural steam that derives its energy from heat found in rock.

*Green Spine* – The corridor through the Rice Creek Commons development that will be designated green space for the use of stormwater management, recreational trails, and parks.

*Greenhouse gases (GHG)* – Those gases, such as water vapor, carbon dioxide, nitrous oxide, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride, that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.

*Ground Source Heat Pump* – A heat pump in which the refrigerant exchanges heat (in a heat exchanger) with a fluid circulating through an earth connection medium (ground or ground water). The fluid is contained in a variety of loop (pipe) configurations depending on the temperature of the ground and the ground area available. Loops may be installed horizontally or vertically in the ground or submersed in a body of water.

*Heat pump* – Heating and/or cooling equipment that, during the heating season, draws heat into a building from outside and, during the cooling season, ejects heat from the building to the outside. Heat pumps are vapor-compression refrigeration systems whose indoor/outdoor coils are used reversibly as condensers or evaporators, depending on the need for heating or cooling.

*Heating Degree Days* – A degree day is the difference in temperature between the outdoor mean temperature over a 24-hour day and a given base temperature. Heating degree days occur when the outdoor mean temperature is below 65 F.

*Heat exchanger* – A pressure vessel that contains plates or tubes and allows the transfer of heat through the plates or tubes from the district heating system water to the building heat distribution system. A heat exchanger is divided internally into two separate circuits so that the district heating system water and the building heat distribution system fluids do not mix.

*Heating coil* – A heating element made of pipe or tube that is designed to transfer heat energy to a specific area or working fluid.

*Hot water supply and return lines* – The district heating system piping that distributes hot water for heating purposes to customers (supply) and returns the cooler water to the Plant for reheating (return).

*Kilowatt (kW)* – A unit of power equal to one thousand Watts (W)

*Kilowatt-hour (kWh)* – A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu.

*Load* – The amount of energy used by a customer. Typically refers to the Peak Load on the system.

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*Medium temperature hot water* – Thermal heat transferred via hot water at a temperature between 190 °F and 250 °F.

*Megawatt (MW)* – One million Watts (W)

*Megawatt-hour (MWh)* – One thousand kilowatt-hours

*Microgrid* – A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid and can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.

*Million BTU (MMBTU)* – One million British Thermal Units (BTU). One MMBTU is equivalent to 293.07 kWh.

*Net Present Value (NPV)* – The difference between the present value of the future cash flows from an investment and the amount of investment. Present value of the expected cash flows is computed by discounting them at the required rate of return. A zero net present value means the project repays original investment plus the required rate of return. A positive net present value means a better return, and a negative net present value means a worse return, than the return from zero net present value.

*Non-diversified load* – The sum of the peak loads of individual users. This is a theoretical maximum system peak load.

*Normalized* – Adjusted annual data of monthly building usage values measured on different monthly heating degree scales to a common scale prior to averaging.

*N+1 Redundancy* – A measure of system component redundancy to provide backup in the event of failure of any one component. N+1 refers to the number of units installed to carry normal load plus one additional unit as backup. For example, if a system has three chillers to achieve the total design load, each is rated at 33% of the total load, or N=3. For this example, an N+1 system will have a total of four chillers of 33% capacity for a total installed capacity of 133% with one chiller providing backup in the event of failure of any one chiller.

*Operations and Maintenance (O&M)* – The activities related to the performance of routine, preventive, predictive, scheduled, and unscheduled actions aimed at preventing equipment failure or decline with the goal of increasing efficiency, reliability, and safety.

*Outside Air Temperature (OAT)* – A measure of the air temperature outside a building. The temperature and humidity of air inside and outside the building are used in enthalpy calculations to determine when outside air can be used for free heating or cooling.

*Passive solar heating* – A solar heating system that uses no external mechanical power, such as pumps or blowers, to move the collected solar heat.

*Peak load/ Peak demand* – The maximum load during a specified period of time

*Photovoltaic and solar thermal energy* – Energy radiated by the sun as electromagnetic waves (electromagnetic radiation) that is converted at electric utilities into electricity by means of solar (photovoltaic) cells or concentrating (focusing) collectors.

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*PSI* – An abbreviation for pounds per square inch. PSI is a unit of pressure measurement.

*Recommissioning* - A type of commissioning that occurs within an existing, operating building to identify ways the building operation is sub-optimal. The decision to recommission may be triggered by a change in building use or ownership, the onset of operational problems, or some other need. *Renewable energy resources* – Energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action

*Resiliency* – The ability to withstand disruptions to the regional or national energy grids or significant volatility to the market price for energy sources.

*Return on Investment (ROI)* – The earning power of assets measured as the ratio of the net income (profit less depreciation) to the average capital employed (or equity capital) in a company or project. Expressed usually as a percentage, return on investment is a measure of profitability that indicates whether or not a company is using its resources in an efficient manner. For example, if the long-term return on investment of a company is lower than its cost-of-capital, then the company will be better off by liquidating its assets and depositing the proceeds in a bank.

*Seasonal energy efficiency ratio (SEER)* – Ratio of the cooling output divided by the power consumption. It is the Btu of cooling output during its normal annual usage divided by the total electric energy input in watt hours during the same period. This is a measure of the cooling performance for rating central air conditioners and central heat pumps.

*Service line/service piping/customer connection* – The segment of the district heating distribution system that extends from the main lines to the inside of the customer building. The service line is typically sized to meet the peak hot water flow requirements for the individual building served by the piping.

*Square Foot (SQ FT or ft<sup>2</sup>)* – Unit of measure to quantify the footprint area of a customer building, used to estimate the Load of a building based on the usage of the building.

*Source Energy* - The total amount of raw fuel that is required to operate an energy-using device or facility. Source energy includes all transmission, delivery, and production losses, thereby enabling a complete assessment of energy efficiency in a building. On the other hand, “Site Energy” is the amount of heat and electricity consumed by a building as reflected in utility bills.

*Solar cooling* – The use of solar thermal energy or solar electricity to power a cooling appliance.

*Solar Photovoltaic Systems (PV)* – Systems that directly convert sunlight into electricity either for use locally or for delivery to the electric grid.

*Solar Thermal* – Systems that directly convert sunlight into heat, generally for domestic hot water though they can also be used to produce space heating.

*Substation* – Facility equipment that switches, changes, or regulates electric voltage.

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*Sustainability* - Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.

*Therm* – One hundred thousand (100,000) Btu

*Thermal energy* – Energy that is generated and measured in the form of heat.

*Thermal Energy Storage* – The storage of heat energy during utility off-peak times at night, for use during the next day without incurring daytime peak electric rates.

*Thumb* – That portion of the Rice Creek Commons development that is at the extreme northwest of the site, and is separated from the remainder of the site by Rice Creek.

*Transit Oriented Development (TOD)* – Land development that takes into account transportation choices as a means of reducing oil and other energy use. Typically it would combine public transit with walkable, mixed-use communities, and approaches to minimize the impact of individual vehicles and commuting.

*Waste Heat Recovery* – An energy conservation system whereby some space heating or water heating is done by actively capturing byproduct heat that would otherwise be ejected into the environment. In nonresidential buildings, sources of waste heat include refrigeration/air-conditioner compressors, manufacturing or other processes, data processing centers, lighting fixtures, ventilation exhaust air, and the occupants themselves. Not to be considered is the passive use of radiant heat from lighting, workers, motors, ovens, etc., when there are no special systems for collecting and redistributing heat.

*Water source heat pump* – A type of (geothermal) heat pump that uses well (ground) or surface water as a heat source. Water has a more stable seasonal temperature than air thus making for a more efficient heat source.

*Variable Air Volume (VAV)* – An HVAC system that has a stable supply-air temperature, and varies the air flow rate to meet the temperature requirements. Compared to constant air volume (CAV) systems, these systems conserve energy through lower fan speeds during times of lower temperature control demand.

*Variable frequency drive* – an electronic controller that controls the speed of an electric motor by modulating input frequency and voltage to match motor speed to the specific demands of the work being performed.