

Key terms

Term	Definition
BIM (Building Information Modelling)	The process of creating and managing digital information for a built environment project that improves visibility and supports collaboration and decision making.
Building services	Systems installed in the built environment to create a comfortable, safe, functional, and efficient environment for building users.
Energy	The capacity to do work.
Kinetic energy	The energy that an object possesses because of its movement.
Potential energy	The energy that is stored in an object due to its relative position.
SAP calculations	Standard Assessment Procedure calculations used to assess and compare the energy and environmental performance of buildings.

Energy

The Law of Conservation of Energy states that energy can neither be created or destroyed but can only be transferred or changed from one form to another.

Forms of energy include thermal, kinetic, electrical, chemical, nuclear, heat, light, and sound.

Energy in the built environment is converted to produce outputs from a wide range of building services systems including building management systems, energy generation, distribution and supply, escalators and lifts, fire safety, detection and protection, heating, ventilation, and air conditioning (HVAC), ICT networks, lighting,

security and alarm systems and water, drainage, and plumbing.

Non-renewable/renewable

Non-renewable sources of energy include coal, oil, and gas. Referred to as fossil fuels as they were formed when prehistoric plants and animals died and were gradually buried under layers of rock. They offer greater energy density (stored energy) than renewable sources, are convenient and can be extracted using the technology available today, but their quantities are finite, and they cause great environmental damage from mining etc., and generate high levels of pollution, such as greenhouse gases and acid rain.

Renewable sources of energy are natural processes that are continuously replenished. This includes sunlight, geothermal heat, wind, tides, water, and various forms of biomass. This energy cannot be exhausted and is constantly renewed. Its use does not pollute the environment but there are difficulties associated with meeting demand and maintaining supplies.

Renewable energy technologies

Solar photovoltaic (PV) power generation is the process of converting energy from the sun into electricity using PV panels. PV systems can also be installed in grid-connected or off-grid (stand-alone) configurations.

Grid-connected PV systems allow homeowners to consume less power from the grid and supply unused or excess power back to the utility grid. Off-grid (stand-alone) PV systems use arrays of PV panels to charge banks of rechargeable batteries, reducing energy costs and providing energy independence.

Solar water heating systems include storage tanks and solar collectors. These systems are either active, which have circulating pumps and controls, or they are passive, which rely on natural temperature movements.

Concentrated solar power (CSP) plants use solar

thermal energy to make steam, which is thereafter converted into electricity by a turbine.

Wind turbines use blades to collect the wind's kinetic energy. Wind flows over the blades creating lift which causes the blades to turn. The blades are connected to a drive shaft that turns an electric generator, which generates electricity. Installations range from small domestic systems to large scale wind farms on land or offshore, where faster and more consistent wind speeds mean that more energy can be generated.

Hydroelectric power converts the potential energy of moving water to power turbines to generate electricity.

Geothermal power refers to using ground source heat energy and a heat pump, which is a device that transfers heat from a source (such as the heat of the soil in the garden) to another location (like the hot-water system of a house). This uses a small amount of electricity, compared with a boiler, but it often achieves a 200-600% efficiency rate, as the amount of heat produced is much higher than the energy consumed.

Bioenergy is a form of renewable energy that is derived from recently living organic materials known as biomass, which can be used to produce transportation fuels, heat, and electricity.

Energy consumption

Energy consumption refers to all the energy used to perform an action or to manufacture something. In a factory, the total energy consumption can be calculated by measuring how much energy a production process consumes, including any associated requirements, such as fuel burned by any delivery vehicles used to move manufactured products to the consumer.

The energy consumption of an appliance or item of plant can be calculated as: **$P = 1000E/t$**

Where Power (P) in watts (W) = 1000 x Energy (E) in kilowatt-hours (kWh)/consumption time period (t) in hours (hr).