**Strategic Energy Management**

**Basics**

**Glossary**



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DISCLAMER: All the definitions in the glossary are for the context of strategic energy management, and for commercial, industrial, and agricultural processes. There may be other definitions which are not included here. This document was developed by Advanced Energy and is not an official document from 50001 Ready or Better Buildings.

Ampere (ăm′pir′) *n. Abbr. AMP, Symbol (I)*

**1.** The basic unit of electric current, equal to one coulomb per second; is used to show the current flowing in an electrical circuit; is related with voltage to the electrical power in a circuit; similar in practical terms to measuring the flow of water in gallons per minute

Capital (kăp′ĭ-tl) *n.*

**1.** Wealth, especially in the form of financial or physical assets, used in the production or accumulation of more wealth.

*adj.*

**1.** Of or relating to financial assets, especially being or related to those financial assets that add to the net worth of a business: made capital improvements at the plant site, purchased a new infrared oven as part of our capital projects

Carburizing (ˈkɑːbjʊˌraɪz ēng) *vb.*

**1.** In metallurgical terms, to increase the carbon content of the surface of a low-carbon steel part, Furnace

a hardened skin on the part treated

**2.** Also known as case hardening, it is frequently used for gears in transmissions and drive trains where excellent wear properties are needed

Combined Heat & Power *n. Abbr. CHP*

**1.** The production of both heat and electricity from the same device or power plant.

Also called: cogeneration, the utilization of wasted heat energy produced by a power plant or industrial process, especially to generate electricity

Competitive Opportunity (kəmˈpɛtɪtɪv) (ŏp′ər-to͞o′nĭ-tē) *adj. n.*

**1.** A favorable or advantageous circumstance that is sufficiently low in price or high in quality to be successful against commercial rivals

Conduction (kənˈdʌkʃən) *n.*

**1.** The transfer of energy by a medium without bulk movement of the medium itself

Convection (kən-vĕk′shən) *n.*

**1.** Heat transfer in a gas or liquid by the circulation of currents from one region to another.

**2.** Fluid motion caused by an external force such as gravity

Curing (kyo͝or ēng) *v.tr.*

**1.** In general, to prepare, preserve, or finish (a substance) by a chemical or physical process.

**2.** In chemistry and in manufacturing, curing is a term that refers to the toughening or hardening of a polymer material by cross-linking of polymer chains, brought about by chemical additives, ultraviolet radiation, electron beam or heat. In rubber, the curing process is called vulcanization

**3.** In manufacturing, curing is sometimes confused with, but is definitely distinct and different from, drying

Dekatherm *n. Abbr. Dth*

**1.** Equivalent to ten (10) therms or 1,000,000 British Thermal Units (BTUs)

**2.** Frequently used as the unit for the delivery and billing of natural gas fuel

**3.** See also, therm

Demand (kW) (dĭ-mănd′) *n.*

**1.** An urgent requirement or need

**2.** In the electrical utility industry, the maximum power level in kilowatts (kW) required by a metered site, based on typically 10-to-15-minute measurement intervals

**3.** Utility bills often have a separate charge for this maximum measured demand level, and this can be quite a large portion of a manufacturing site’s total electric bill

Demand Side Management (DSM) *n. Abbr. DSM*

**1.** The process of looking at the operational characteristics and sequencing on demand or load side of the electrical feeder to avoid and reduce spikes in electrical power demand. Reducing the overall peak in electrical demand can save money on the electrical bill.

Drying (drī’ ēng) *v.*

**1.** Removing the moisture from; make dry: laundry drying in the sun

**2.** Preserving (meat or other foods, for example) by extracting the moisture: drying beef jerky

**3.** In manufacturing drying is one of the most common processes and is used in many markets and process

**4.** Drying can be done using various energy sources such as natural gas, electrical resistance heating, infrared heating, microwave heating, and radio frequency heating

Electron Beam (EB) (ĭ-lĕk′trŏn′) (bēm) *n. Abbr. EB*

**1.** An electron is a stable elementary particle having a negative electric charge

**2.** Electrons are found in shells orbiting the nuclei of atoms and can also move freely through space as cathode rays in a cathode-ray tube or as beta particles emitted by radioactive nuclei, or flow in a current through a conducting material impelled by an electric potential difference

**3.** A beam is a concentrated stream of particles or a similar propagation of waves: a beam of electrons; a beam of light.

**4.** Electron Beam technology is basically a streaming beam of electrons that is useful in curing chemically activated coatings on a wide variety of substrates and when more concentrated can be used for heavy industrial process such as cutting and welding

Energy *n.*

**1.** A quantity that must be transferred to an object or system to perform work on or to heat up the object or system, typical units are kWh, BTU, foot-pound

**2.** Related to power in that: ENERGY = POWER x TIME

Energy Efficiency *n.*

**1.** The ratio of useful energy output divided by the total energy input for a system and is a percentage less than 100%

**2.** Another way to look at this is the (total energy input – losses) / total energy input, also as a percentage less than 100%

Energy Intensity *n.*

**1.** A measure of the amount of energy needed in terms of kilowatt-hours or BTU’s to create a unit of manufactured product

e.g., BTU/ton, kWh/linear yard, kWh/pound

**2.** An indicator of the relative energy use of a process or industry when compared to other energy intensities

e.g., melting steel has a high process energy intensity compared to drying coatings on textiles

Equipment (ɪˈkwɪp mənt) *n.*

**1.** The articles, implements, etc., used or needed for a specific purpose or activity: manufacturing equipment

**2.** For the purpose of this class, the fifth letter in the PUPPET model

Extraction (ɪkˈstrækʃən) *n.*

**1.** The process of removing or obtaining a substance by chemical or mechanical action, such as pressure, distillation, or evaporation

**2.** For industrial processes, extraction often refers to removing raw materials from their base source

**3.** Extraction frequently applies to industries such as mining and minerals, petroleum, and primary metals

**4.** Examples of extraction in the context of industrial process include refining crude oil, mining iron ore, and processing bauxite into aluminum ingots

Fluid (ˈfluːɪd) *n.*

**1.** A substance, such as a liquid or gas, that can flow, has no fixed shape, and offers little resistance to an external stress

**2.** In manufacturing, fluids are used for all types of processes and can be either raw materials or finished products

**3.** The heating of fluids is frequently required in the manufacturing process and can be energy intense

Forming (form’ ēng) *v.*

**1.** To make or fashion by shaping: the car headliners were heated prior to forming

Furnace (fûr′nĭs) *n.*

**1.** An enclosure in which energy is applied to produce heat at a specific temperature level to perform a process on a subject object: the gears were treated in an annealing furnace after carburizing to relieve internal stresses

**2.** Typically, in practice, furnaces operate in temperature ranges above 500ºF

Heat treatment (HT) (hēt) (trēt′mənt) *n. Abbr. HT*

**1.** The general set of operations involving the application of heat from a variety of energy sources at a desired temperature, in a selected atmosphere and for a determined dwell time to create repeatable and desirable conditions in the internal structure of metals

**2.** Typical processes in the heat treatment family include: annealing, carburizing, tempering, case hardening, induction hardening, etc.

Heating (hēt ēng) *v.*

**1.** To increase the molecular or kinetic energy of an object

**2.** In manufacturing, heating is one of the most common and most energy intense processes, used almost everywhere in many forms

Horsepower (hp) (hôrs′pou′ər) *n. Abbr. hp*

**1.** A unit of power in the US Customary System, equal to 745.7 watts or 33,000 foot-pounds per minute

Induction (ɪnˈdʌk ʃən) *n.*

**1.** The process by which a body having electric or magnetic properties produces magnetism, an electric charge, or an electromotive force in a neighboring body without visible contact

**2.** Frequently used in manufacturing for heating or melting metals: induction heating, induction melting

Infrared (ĭn′frə-rĕd′) *adj. Abbr. IR*

**1.** Of or relating to electromagnetic radiation between microwaves and red visible light in the electromagnetic spectrum, having frequencies between 300 gigahertz and 400 terahertz and wavelengths between 1 millimeter and 750 nanometers.

**2.** Frequently used in manufacturing for a heat source for curing and drying all types of products and coatings on substrates

Jargon (jär′gən) *n.*

**1.** The specialized language of a trade, profession, or similar group, especially when viewed as difficult to understand by outsiders: a crime novel that uses a lot of police jargon

**2.** Nonsensical or incoherent language: "Your description will be considered as mere jargon by every man of sense" (Alexander Hamilton)

Kilowatt (kW) (kĭl′ə-wŏt′) *n. Abbr. kW*

**1.** A unit of power equal to 1,000 watts

**2.** The kW is the unit of power that electrical utilities use to measure power demand for an industrial customer

**3.** Utility bills often have a separate charge for power demand level (kW), and this can be quite a large portion of a manufacturing site’s total electric bill

Kilowatt-hour (kWh) (kĭl′ə-wŏt′) (our) *n. Abbr. kWh*

**1.** A unit of work or energy equal to that done by one kilowatt acting for one hour

**2.** The unit of kWh is used by the utility industry to invoice their customers

**3.** In manufacturing, the number of kilowatt-hours consumed is indicative of the energy intensity of the process

Load Factor (Electric Utility) *n.*

**1.** In [electrical engineering](http://en.wikipedia.org/wiki/Electrical_engineering) and for electric utilities the load factor is defined as the average load divided by the peak load in a specified time period

 f_{Load} = \frac{\text{Average load}}{ \text{Maximum load in given time period}}

Here is an example of an industrial electrical bill: kW Demand = 3,200 kW; kWh Use = 1,275,000 kWh; Number of days in billing cycle = 32 days

Load Factor [%] = (1,275,000 kWh / (32 days X 24 hours per day)) / 3,200 kW X 100% = 51.9%

Load Factor (Plant Operations) *n.*

**1.** The operation time of a process or piece of equipment in a manufacturing plant based on the shifts, days, and weeks per year of operation. See below for more details on this

**2.** The load factor can be expressed in total operation hours or in a percentage base on total operation hours divided by a full year of hours, which is 8,760 hours

Shifts/Day = 1, 2, or 3 eight hour shifts per day, typically 2 or 3 for manufacturing plant operations, in some cases may be two, ten hours shifts per day or some other combination to suit the operations

Days/Week = 1–7 days per week, typically 5-7 for manufacturing plant operations

Weeks/Year = Up to 52 weeks per year, most manufacturing plants have one to two weeks of shutdown per year for maintenance, typically 50 weeks is an average number

Melting (melt ēng) *v.*

**1.** To be changed from a solid to a liquid state especially by the application of heat

Microwave (Mw) (mī′krə-wāv′) *adj. Abbr. MW*

**1.** Relating to or being electromagnetic radiation between radio waves and infrared waves in the electromagnetic spectrum, having frequencies between 300 megahertz and 300 gigahertz and wavelengths between 1 meter and 1 millimeter.

**2.** Frequently used in residential and commercial

**3.** Frequently used in manufacturing for a heat source for processing foods and other products

North American Industry Classification System (NAICS) *n. Abbr. NAICS*

**1.** The North American Industry Classification System (NAICS) is used by businesses and governments to classify and measure economic activity in the United States, Canada, and Mexico. NAICS is 6-digit code system that is currently the standard used by federal statistical agencies in classifying business establishments.

**2.** This system replaced the older SIC system

Natural Gas Convection Oven *n.*

**1.** An industrial process oven that uses natural gas as a fuel and uses force convection via fans to move heated air in and around manufactured items for the purposes of heating, drying, or curing the product

**2.** Typical application include curing powder paint, drying inks and paints, drying textile coatings, baking food products, etc.

Net Present Value (NPV) *n. Abbr. NPV*

**1.** (Accounting & Book-keeping) *accounting* an assessment of the long-term profitability of a project made by adding together all the revenue it can be expected to achieve over its whole life and deducting all the costs involved, discounting both future costs and revenue at an appropriate rate

Original Equipment Manufacturer (OEM) *n. Abbr. OEM*

**1.** The first or original producer of a part or a system

**2.** Typically used to refer to the company that makes a part that is used by an upstream company: If gears are manufactured by Atlas Gear Company, and then these gears are used in Ford truck transmissions, then Ford would consider Atlas the OEM of the gears.

**3.** Another way this is used is for vendors of turnkey processing systems: If Custom IR builds a complete IR oven for John Deere to use to cure powder paint on some of their assemblies, then John Deere would consider Custom the OEM of the IR oven.

On-Site Generation (OSG) *n. Abbr. OSG*

**1.** The private or utility owned asset at an industrial plant site that generates electricity for back-up, emergency, or intermittent use

**2.** This can be in the form of a natural gas or diesel fired electric generator, part of a CHP system, or a renewable energy source

**3.** Many utilities have OSG programs to help their industrial customers

Oven (ŭv′ən) *n.*

**1.** An enclosure in which energy is applied to produce heat at a specific temperature level to perform a process on a subject object: the textile coating was dried in a convection oven

**2.** Typically, in practice, ovens operate in temperature ranges below 500ºF

Paint Booth *n.*

**1.** A piece of industrial equipment typically used for the application of liquid or powder paint coatings on a wide variety of manufactured items

**2.** A paint booth is typically followed by a curing or drying oven to finish the painting process and ensure that the paint adheres properly to the item

Plasma (plăz′mə) *n.*

**1.** An electrically neutral, highly ionized phase of matter composed of ions, electrons, and neutral particles

**2.** It is distinct from solids, liquids, and gases

**3.** Plasmas are produced by very high temperatures, as in the sun and other stars, and by the ionization resulting from exposure to an electric current, as in a fluorescent light bulb or a neon sign.

**4.** It is used in manufacturing for welding, cutting, and melting

Power *n.*

**1.** The amount of energy transferred or converted per unit of time, typical units are kW, BTU/hour, horsepower

**2.** The rate of energy transfer

**3.** Related to energy in that: POWER = ENERGY/TIME

Power Quality *n.*

**1.** With reference to the electric utility industry, this determines the fitness of electric power to consumer devices. Synchronization of the voltage frequency and phase allows electrical systems to function in their intended manner without significant loss of performance or life.

**2.** Power Quality may be one of the issues that Key Account Managers face when working with their industrial customers

**3.** More and more of todays sophisticated manufacturing equipment is sensitive to power quality

Primary Market *n.*

**1.** A key part of the PUPPET model, this is the most important or principal business transaction arena that a company works in: Ford is a big player in the automotive market, Coca Cola is a leader in the Food and Beverage market

**2.** For the PUPPET model, Primary Market is the first “P” and is the ultimate destination for the products of an industrial company: GKN Driveline makes front wheel drive half shafts and their primary market is Automotive

Process (prŏs′ĕs′) *n. pl. proc·ess·es*

**1.** A series of actions, changes, or functions bringing about a result: the process of digestion; the process of obtaining a driver's license.

**2.** A series of operations performed in the making or treatment of a product: a manufacturing process; leather dyed during the tanning process

**3.** For the purpose of this class, the fourth letter in the PUPPET model

Product (prŏd′əkt) *adj.*, *n.*

**1.** Something produced by human or mechanical effort or by a natural process or something that is made or refined

**2.** Something that has been brought to a state of completion.

**3.** REMEMBER: One plant’s finished product is another plant’s raw materials

**4.** For the purpose of this class, the third letter in the PUPPET model

PUPPET (pŭp′ĭt) *n.*

**1.** PUPPET is an acronym used as a teaching aid to help understand the transformation of raw materials into final products in a manufacturing environment

**2.** The PUPPET model is the continuous series of steps from basic technologies to diverse primary markets that model the overall manufacturing process

**3.** PUPPET stands for: Primary Market, Use, Product, Process, Equipment and Technology

**4.** In summary: **Technology** is built into a piece of **Equipment** that performs a **Process (PET)** that takes *raw material* and *transforms* it into a **Product** that has a specific **Use** in a defined **Primary Market** segment of the economy **(PUP), (i.e., PUPPET)**

Radiation (rā′dē-ā′shən) *n.*

**1.** Emission or propagation of energy in the form of waves or particles: the radiation of heat and light from a fire.

**2.** Energy radiated or transmitted in the form of waves or particles.

Radio Frequency (RF) *n. Abbr. RF*

**1.** The frequency of the waves transmitted by a specific radio station.

**2.** A frequency within the range at which radio waves are transmitted, conventionally from 3 hertz to 300 megahertz, immediately below the range of microwave frequencies in the electromagnetic spectrum.

**3.** In manufacturing RF can be used as a heat source for cooking foods or welding plastic, as well as many other applications.

Raw Material *n.*

**1.** An unprocessed natural product used in manufacture.

**2.** Unprocessed material of any kind:

**3.** REMEMBER: One plant’s finished product is another plant’s raw materials.

Reliability (rĭ-lī′ə-bəl ĭ tē) *n.*

**1.** The state of having very high dependability, something you can always count on: as my utility, Pee Dee Electric has exceptional reliability

*adj.* reliable

**2.** Providing the same or compatible results repeatedly: Pee Dee Electric always had reliable power quality

Resistance heating (rĭ-zĭs′təns) *n.*

**1.** Heating caused by the opposition of a body or substance to electrical current passing through it; resistance heating elements are used in ovens

**2.** Resistance heating is the most common form of electrical heating used in manufacturing and comes in all shapes and sizes

Return on Investment (ROI) *n. Abbr. ROI*

**1.** A financial term for return per dollar invested. It is a measure of investment performance

**2.** Mathematically the return on investment (*r*) is:

r=\frac{V_f - V_i}{V_i}  Where:

V_f= final value, including dividends and interest

V_i= initial value

1. For example: if you invested $100,000 in a piece of equipment and with savings, depreciation, and operational costs you calculated and value for your investment of $115,000 at the end of one year, then you ROI would be (115,000-100,000)/100,000 = 15%

Standard Industrial Classification (SIC) *n. Abbr. SIC*

**1.** Standard Industrial Classification (SIC) codes are four-digit numerical codes assigned by the U.S. government to business establishments to identify the primary business of the establishment. The classification was developed to facilitate the collection, presentation, and analysis of data; and to promote uniformity and comparability in the presentation of statistical data collected by various agencies of the federal government, state agencies and private organizations. The classification covers all economic activities

**2.** This system is now replaced with NAICS

Simple Payback *n.*

**1.** A mathematical way to check the amount of calendar time (typically in years) it will take for the savings resulting from a project to cover or pay back the cost of implementing the project, without any interest rates or time value of money included (i.e., simple)

**2.** As a formula it is the total cost of a project divided by the annual savings

**3.** Example: The cost to purchase and install a new Infrared (IR) oven is $200,000

The savings in energy and other operational costs is $100,000 per year

The Simple Payback = $200,000/$100,000 per year = 2.0 years

Sub-Metering *v.*

**1.** The process of installing power meters inside of the manufacturing plant downstream of the main utility power meter for the purposes of measuring electrical energy consumption for specific loads: the maintenance department installed sub-metering on the three air compressors

**2.** The technique is frequently used in energy projects to determine the electrical energy consumption before and after the implementation of an energy project

**3.** Sub-metering data is useful for completing project financial analysis

Technology (tĕk-nŏl′ə-jē) *n. pl. tech·nol·o·gies*

**1.** The application of science, especially to industrial or commercial objectives.

**2.** The scientific method and material used to achieve a commercial or industrial objective

**3.** For the purpose of this class, the sixth and last letter in the PUPPET model.

Tenter Frame *n.*

**1.** Specific to the textile industry, this is the commonly used name for a natural gas convection oven with a conveyor designed to grab and hold a width of cloth material tightly to facilitate the drying of coatings or dyes: we added and IR booster oven in front of the tenter frame to help increase the drying speed for the textile coatings

Therm (thûrm) *n.*

**1.** A unit of heat equal to 100,000 British thermal units BTUs (1.054 × 108 joules)

**2.** Frequently used as the unit for the delivery and billing of natural gas fuel

**3.** See also, dekatherm, which equals ten (10) therms

Tier 1 Supplier *n.*

1. Typically used in the automotive industry, this refers to a supplier that provides product directly to the automotive production plant: GKN Driveline is a Tier 1 Supplier for front wheel drive half shafts to numerous automotive OEMs including Toyota, Honda, BMW, and Ford

Tier 2 Supplier *n.*

1. Typically used in the automotive industry, this refers to a supplier that provides product to a Tier 1 Supplier

2. The Tier 2 Supplier provides product to the Tier 1 Supplier who provide product to the automotive OEM: Mack Heat Treat is a Tier 2 Supplier to GKN Driveline providing bearing components for the front wheel drive half shafts

Transformation (trăns′fər-mā′shən) *n.*

**1.** The act or an instance of transforming

**2.** The state of being transformed

**3.** A marked change, as in appearance or character, usually for the better

**4.** In manufacturing, the process of changing raw materials into finished products

Ultraviolet (UV) (ŭl′trə-vī′ə-lĭt) *adj. Abbr. UV*

**1.** Of or relating to electromagnetic radiation between violet visible light and x-rays in the electromagnetic spectrum, having frequencies between 790 terahertz and 30 petahertz and wavelengths between 380 nanometers and 10 nanometers.

**2.** Of or relating to a light bulb that emits ultraviolet radiation.

**3.** In manufacturing, UV can be used to cure photosensitive coatings and printing inks on a wide variety of substrates such as food packaging and papers, cardboard, and films.

Use (yo͞oz) *v. used, us·ing, us·es*

**1.** To put into service or employ for a purpose

**2.** For the purpose of this class, the second letter in the PUPPET Model

Vacuum (văk′yo͞om) *n.*

**1.** General definitions:

**a.** Absence of matter

**b.** A space empty of matter

**c.** A space relatively empty of matter

**d.** A space in which the pressure is significantly lower than atmospheric pressure

**2.** Typically used in industrial processes to remove all atmospheric oxygen which interferes with many heat-treating processes by causing oxidation: vacuum carburizing is an excellent method for case hardening steel

Value Added *n.*

**1.** (Economics) the difference between the total revenues of a firm, industry, etc., and its total purchases from other firms, industries, etc.

**2.** Similarly, in industrial manufacturing plants, it is the increase in value of a product through the transformation processes from raw material to finished product.

**3.** In some cases it is defined as “what the customer is willing to pay for”. Example: The raw material costs for the clay for each vase is $2.00 and we can sell each vase to our customers for $12.00 each. The value added per vase is $10.00.

Volt (V) (vōlt) *n. Abbr. V*

The SI-derived unit of electric potential and electromotive force, equal to the difference of electric potential between two points on a conducting wire carrying a constant current of one ampere when the power dissipated between the points is one watt

Waste Heat Recovery (WHR) *n. Abbr. WHR*

**1.** Waste Heat Recovery: The process of finding wasted heat energy produced by a power plant or industrial production process and then making use of that heat in another process, thereby saving the input energy needed for this other process.

**2.** WHR can make an overall process or production line more energy efficient

Watt (W) (wŏt) *n. Abbr. W*

**1.** The unit of power: one watt equals one joule per second.

**2.** A unit of power equal to that available when one joule of energy is expended in one second. 1 W = 1 volt-ampere; 746 W = 1 horsepower (hp). **3. 3.** Named after the Scottish engineer James Watt (1736–1819).