

Outline of energy

See also: [Index of energy articles](#)

The following outline is provided as an overview of and topical guide to energy:

Energy – in physics, this is an indirectly observed quantity often understood as the ability of a physical system to do work on other physical systems.^{[1][2]} Since work is defined as a force acting through a distance (a length of space), energy is always equivalent to the ability to exert force (a pull or a push) against an object that is moving along a definite path of certain length.

1 Forms of energy

- **Chemical energy** – energy contained in molecules
- **Electric energy** – energy from electric fields
- **Gravitational energy** – energy from gravitational fields
- **Ionization energy** – energy that binds an electron to its atom or molecule
- **Kinetic energy** – (≥ 0), energy of the motion of a body
- **Magnetic energy** – energy from magnetic fields
- **Mechanical energy** – The sum of (usually macroscopic) kinetic and potential energies
- **Mechanical wave** – (≥ 0), a form of mechanical energy propagated by a material's oscillations
- **Nuclear binding energy** – energy that binds nucleons to form the atomic nucleus
- **Potential energy** – energy possessed by a body by virtue of its position relative to others, stresses within itself, electric charge, and other factors.^{[3][4]}
 - **Elastic energy** – energy of deformation of a material (or its container) exhibiting a restorative force
 - **Gravitational energy** – potential energy associated with a gravitational field.
 - **Nuclear potential energy**
- **Radiant energy** – (≥ 0), energy of electromagnetic radiation including light

- **Rest energy** – (≥ 0) that $E=mc^2$ an object's rest mass
- **Surface energy**
- **Thermal energy** – a microscopic, disordered equivalent of mechanical energy
 - **Heat** – an amount of thermal energy being transferred (in a given process) in the direction of decreasing temperature
- **Work (physics)** – an amount of energy being energy transfer in a given Process (thermodynamic) due to displacement in the direction of an applied force

2 Measurement

2.1 Units

Main article: [Units of energy](#)

- **Barrel of oil equivalent** ($\sim 6.1178632 \times 10^9$ J)
- **British thermal unit** (~ 1055 J)
- **Calorie** (~ 4.184 J)
- **Current solar income** – the amount of solar energy that falls as sunlight
- **Electronvolt** – (symbol: eV) is the amount of energy gained by a single unbound electron when it falls through an electrostatic potential difference of one volt. ($\sim 1.602 \times 10^{-19}$ J)
- **Planck energy**, 1.22×10^{28} eV (1.96×10^9 J)
- **Erg** – (symbol “erg”) unit of energy and mechanical work in the centimetre-gram-second (CGS) system of units
- **Foot-pound** – (symbol ft·lbf or ft·lbf) is an Imperial and U.S. customary unit of mechanical work, or energy, although in scientific fields one commonly uses the equivalent metric unit of the joule (J). There are approximately 1.356 J/(ft·lbf).
- **Joule** – (symbol J, also called newton meter, watt second, or coulomb volt)

- **Therm** – (symbol thm) a non-SI unit of heat energy. It is approximately the heat equivalent of burning 100 cubic feet of natural gas. In the US gas industry it is defined as exactly 100,000 BTU_{59 °F} or 105.4804 megajoules.
- **Kilowatt-hour** – (symbol: kW·h) corresponds to one kilowatt (kW) of power being used over a period of one hour.
- **Ton of oil equivalent**
- **TPE** – Ton Petroleum Equivalent, 45.217 GJ, see ton of oil equivalent

2.2 Related units and concepts

- **Volt**
- **Ampere**
- **Coulomb**
- **Enthalpy**
- **EU energy label**
- **Fill factor** – defined as the ratio of the maximum power ($V_{mp} \times I_{mp}$) divided by the short-circuit current (I_{sc}) and open-circuit voltage (V_{oc}) in light current density – voltage (J-V) characteristics of solar cells.
- **Gigaton** – Metric Unit of mass, equal to 1,000,000,000 (1 billion) metric tons, 1,000,000,000,000 (1 trillion) kilograms
 - Any of various units of energy, such as gigatons of TNT equivalent, gigatons of coal equivalent, gigatons petroleum equivalent.
- **Gray (unit)** – (symbol: Gy), is the SI unit of energy for the absorbed dose of radiation. One gray is the absorption of one joule of radiation energy by one kilogram of matter. One gray equals 100 rad, an older unit.
- **Heat**
- **Mass-energy equivalence** – where mass has an energy equivalence, and energy has a mass equivalence
- **Megawatt**
- **Net energy gain**
- **Power factor** – of an AC electric power system is defined as the ratio of the real power to the apparent power.

3 Energy industry

Main article: [Energy industry](#)

- **Worldwide energy supply**, outline by country/region
- **World energy resources and consumption**
- **List of energy resources**, substances like fuels, petroleum products and electricity
- **Energy crisis**, the need to conserve energy resources
- **Energy development**, development of energy resources — ongoing effort to provide abundant and accessible energy, through knowledge, skills and construction
- **Embodied energy**, the sum total of energy expended to deliver a good or service as it travels through the economy
- **Energy conservation**, tips for conserving energy resources
- **Energy economics**, as the foundation of other relationships
- **Energy policy**, government policies and plans for energy supply
- **Energy storage**, methods commonly used to store energy resources for later use
- **Energy system**, an interpretation the energy sector in system terms
- **Biosphere**
- **Ecological energetics**
- **Ecology**
- **Energy balance**
- **Earth Day**
- **U4energy**, a pan European school challenge on energy education launched in September 2010. U4energy is an initiative funded under the IEE programme to improve energy consumption in schools and their local communities.
- **Energy speculation**
- **Free energy suppression**
- **Future energy development** – Provides a general overview of future energy development.
- **History of perpetual motion machines**

- Hubbert peak theory, also known as **peak oil** – the theory that world oil production will peak (or has peaked), and will then rapidly decline, with a corresponding rapid increase in prices.
- Primary production
- Power harvesting
- Renewable energy development

3.1 Energy infrastructure

See especially Category:Electric power and Category:Fuels for a large number of conventional energy related topics.

- Energy storage
- Electricity generation
- Electricity retailing
- Grid energy storage
- Liquefied natural gas
- Microwave power transmission
- Power plant
- Power supply
- Power transmission
- Underground power station

3.2 Energy applications

- Biofuel
- Distributed generation
- Electric vehicle
- Hybrid vehicle
- Hydrogen vehicle
- Passive solar building design
- Steam engine

4 History of energy

Main article: History of energy

- History of the energy industry
 - History of coal

- History of coal mining
- History of electricity
 - History of the electric generator
 - History of the electric motor
 - Timeline of the electric motor
 - History of electric power transmission
- History of nuclear power
- History of petroleum
 - History of the petroleum industry
- History of renewable energy
 - History of alternative energy
 - History of hydropower
 - History of solar cells
 - Growth of photovoltaics
 - History of sustainability
 - History of wind power
- History of the steam engine
 - Steam power during the Industrial Revolution

5 Physics of energy

- Energy
- Activation energy explains the differences in the speeds of various chemical reactions
- Alternative energy indexes
- Bioenergetics
- Chemical energetics
- Energy in physical cosmology
- Energy in Earth science that is responsible for the macroscopic transformations on the planet Earth
- Electricity
- Exergy
- Green energy
- Orders of magnitude (energy) – list describes various energy levels between 10^{-31} joules and 10^{70} joules
- Thermodynamics
- Perpetual motion
- Heat
- History of energy
- Forms of energy, the forms in which energy can be defined

- **Energy transformation**, relating to energy's changes from one form to another.
 - **Energy (signal processing)**, the inner product of a signal in the time domain
 - **Energy density spectrum**, relating to the distribution of signal energy over frequencies.
 - **Potential energy**, the form of energy that is due to position of an object
 - **Kinetic energy**, the form of energy as a consequence of the motion of an object or its constituents
 - **Mechanical energy**, the potential energy and kinetic energy present in the components of a mechanical system.
 - **Binding energy**, a concept explaining how the constituents of atoms or molecules are bound together
 - **Bond energy**, a measure of the strength of a chemical bond
 - **Nuclear energy**, energy that is the consequence of decomposition or combination of atomic nuclei
 - **Osmotic power**, or salinity gradient power and **blue energy**, is the energy available from the difference in the salt concentration between seawater and river water
 - **Gibbs free energy**, a related concept in chemical thermodynamics that incorporates entropy considerations too
 - **Helmholtz free energy**, a thermodynamic potential that measures the "useful" work obtainable from a closed thermodynamic system at a constant temperature, useful for studying explosive chemical reactions
 - **Elastic energy**, which causes or is released by the elastic distortion of a solid or a fluid
 - **Ionization energy** – the (IE) of an atom is the energy required to strip it of an electron.
 - **Interaction energy**, the contribution to the total energy that is a result of interaction between the objects being considered
 - **Internal energy** – (abbreviated E or U) the total kinetic energy due to the motion of molecules (translational, rotational, vibrational) and the total potential energy associated with the vibrational and electric energy of atoms within molecules.
 - **Negative energy**
 - **Energy conversion** – process of converting energy from one form to another
 - **Dark energy**, used to explain some cosmological phenomena
 - **Energy quality**, empirical experience of the characteristics of different energy forms as they flow and transform
 - **Energy density**, amount of energy stored in a given system or region of space per unit volume, or per unit mass
 - **Energy flow**, flow of energy in an ecosystem through food chains
 - **Energetics**, the scientific study of energy flows under transformation
 - **Stress–energy tensor**, the density and flux of energy and momentum in space-time; the source of the gravitational field in general relativity
 - **Food energy**, energy in food that is available
 - **Primary energy** – Energy contained in raw fuels and any other forms of energy received by a system as input to the system.
 - **Radiant energy** – energy that is transported by waves
 - **Rotational energy** – An object's rotational energy or angular kinetic energy is part of its total kinetic energy
 - **Solar radiation** – radiant energy emitted by the sun, particularly electromagnetic energy
 - **Tidal power**, also called tidal energy, is a form of hydropower that converts the energy of tides into useful forms of power - mainly electricity, dynamic tidal power, tidal lagoons, Tidal barrage
 - **Wave power** is the transport of energy by ocean surface waves, and the capture of that energy to do useful work — for example, electricity generation, water desalination, or the pumping of water (into reservoirs). Machinery able to exploit wave power is generally known as a wave energy converter (WEC).
 - **Wind energy** is the kinetic energy of air in motion; **Wind power** is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, windmills for mechanical power, windpumps for water pumping or drainage, or sails to propel ships
- ## 5.1 Allegorical and esoteric
- **Energy (esotericism)**, invoked by spiritualists for alternative modes of healing the human body as well as a spirit that permeates all of reality.

- Orgone, Wilhelm Reich discovered this energy and tried to use it to cure various physical ailments and control the weather.
- Bioenergetic analysis, body-oriented Reichian psychotherapy
- Qi a concept from Oriental medicine that is sometimes translated as “energy” in the West.
- Vitalism, often referred to as “energy”
- Cold fusion, nuclear fusion at conditions close to room temperature.
- Bubble fusion, also known as **Sonofusion**, energy from acoustic collapse of bubbles.
- Water-fuelled car, powering a car using water as fuel.

6 Politics

6.1 Energy issues

- 2000 Watt society
- Environmental concerns with electricity generation
- Fuel poverty
- Greasestock, American showcase of vehicles and technologies powered by alternative energy
- Low-carbon economy
- Peak Oil
- Soft energy path – an energy use and development strategy delineated and promoted by some energy experts and activists
- Strategic Petroleum Reserve (disambiguation)

6.2 Energy policies and use – national and international

6.2.1 International

- Energy policy – an introductory article
- Energy and Environmental Security Initiative (EESI)

6.2.2 Regional and national

Main page: Energy policy by country

- Energy law – overview of many energy laws from various countries and states
 - New York energy law
- *Energy Tax Act* – United States energy-related legislation. See also : Category:United States federal energy legislation
- United Kingdom:
 - Energy policy of the United Kingdom
 - Energy use and conservation in the United Kingdom

7 Economics

Main article: Energy economics

7.1 Energy companies

- Exxon Mobil
- Enercon GmbH – Company based in Germany that operates in the wind turbine industry. One of the biggest producers in the world.
- Saudi Aramco
- Sasol
- United States Enrichment Corporation – contracts with the United States Department of Energy to produce enriched uranium.

7.2 Non-profit organizations

- Musicians United for Safe Energy

7.3 Industry associations

- OPEC – Organization of Petroleum-exporting Countries
- IEA – International Energy Agency
- CAPP – Canadian Association of Petroleum Producers
- World LP Gas Association – WLPGA

8 Innovators

- Alessandro Volta
- Charles Kettering
- Farrington Daniels – solar energy
- Georges Leclanché – battery
- John Frederic Daniell – Daniell cell
- Rudolf Diesel – compression ignition internal combustion engine
- Georges Imbert – wood gas
- Leonardo da Vinci
- Moritz von Jacobi
- Nikolaus Otto – internal combustion engine
- Robert Stirling – Stirling engine (external combustion)
- Nikola Tesla
- James Watt – steam engine with separate condensor

9 Lists

- List of books about energy issues
- List of energy abbreviations
- List of energy storage projects
- List of large wind farms
- List of notable renewable energy organizations
- List of photovoltaics companies
- List of renewable energy topics by country
- List of solar thermal power stations
- Index of wave articles
- List of wind turbine manufacturers

10 See also

- Energy (disambiguation)
- List of environment topics

11 References

- [1] “Retrieved on 2010-Dec-05”. Faculty.clintoncc.suny.edu. Retrieved 2010-12-12.
- [2] “Retrieved on 2010-Dec-05” (PDF). Retrieved 2010-12-12.
- [3] Jain, Mahesh C. “Fundamental forces and laws: a brief review”. *Textbook Of Engineering Physics, Part 1*. PHI Learning Pvt. Ltd. p. 10. ISBN 9788120338623.
- [4] McCall, Robert P. (2010). “Energy, Work and Metabolism”. *Physics of the Human Body*. JHU Press. p. 74. ISBN 978-0-8018-9455-8.

12 External links

- This outline displayed as a mindmap, at *wiki-mindmap.com*

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