

---

# ENERGY REFERENCE HANDBOOK

Third Edition

---



Government Institutes, Inc.

# ENERGY REFERENCE HANDBOOK

Edited by  
Thomas F.P. Sullivan, Esq.  
and  
Martin L. Heavner



Government Institutes, Inc.  
Third Edition, 1981

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the publisher.

June 1981

Copyright © 1981 by Government Institutes, Inc.  
966 Hungerford Drive, #24, Rockville, Maryland 20850

Library of Congress Catalog No. 80-84728

International Standard Book Number: 0-86587-082-9

Printed and bound in the United States of America

**Library of Congress Cataloging in Publication Data**  
Main entry under title:

Energy reference handbook.

1. Power resources--Dictionaries. 2. Power (Mechanics)--Dictionaries. 3. Force and energy--Dictionaries. I. Sullivan, Thomas F. P. II. Heavner, Martin L. 1955-

TJ163.L6.B53 1981  
ISBN 0-86587-082-9

621.042 '03'21

80-84728  
AACR2

## ACKNOWLEDGEMENTS

A great deal of research went into the compilation of this glossary, and a list of the publications most widely referenced as source material is given on page viii. Those who have assisted us are too numerous to acknowledge; however, we are very grateful to Carl Hall, Dean of Engineering at Washington State University, and Elliot Boardman, Vice President of Government Institutes for their technical assistance on this Third Edition. Special thanks to the Government Institutes' research staff: Roland Schumann, for his dedicated attention for gathering new source material and to Charlene Ikonou for her editorial production of the publication.

We also would like to thank the readers of our First and Second Editions of the ENERGY REFERENCE HANDBOOK for their constructive comments and suggestions, and we hope that they and others will offer the same for this Edition.

## PREFACE

The field of energy technology has literally exploded in the 1970's. We find ourselves now using terms that did not even exist several years ago. In addition, many words have developed uses somewhat different from their commonly accepted meanings.

In June of 1974, Government Institutes conducted and sponsored the 1st Energy Technology Conference in Washington, D.C. One result of that conference was the recognition that the need existed for a reference source incorporating the key words and terms frequently used in the various segments of the energy field. So, the First Edition of the ENERGY REFERENCE HANDBOOK was created to fill that need. The First Edition in 1974 was so well received that it sold out, necessitating publication of a Second Edition in 1977. The success of the Second Edition resulted in our preparing this expanded and even more comprehensive Third Edition.

Many readers have provided constructive guidance and suggestions on terms and materials to be added to the book that would increase its value as a reference—to these readers we are indebted. Out-of-date terms have been culled and replaced with the most current terms. Special attention has been paid to those terms peculiar to each area within the energy technology field, namely: coal, nuclear, oil, gas, solar, wind, ocean power, geothermal, shale, and the environment.

In addition to the definitions, we have added many tables and charts on the various aspects of energy which forecast the reserves of various fuel resources, plus other information which we believe is relevant to a handy reference volume; the conversion tables are especially important as the United States enters the metric age.

We have endeavored to compile and define the most common terms to result in a better understanding of the terminology used in each energy application. In many cases it is sometimes difficult to settle upon a single definition acceptable to all concerned, who may represent broad and varied areas of pursuits and interests. We have in many instances, therefore, chosen to give several definitions with the anticipation that the final effort will be acceptable to all.

There is a need to recognize the interdependence of the various forms of energy and the interactions of the countries and regions of the world. We ascribe to the concept that all forms of energy will be needed in the future to satisfy the world's energy supply needs and that we all must view this supply/demand scenario as a world energy system.

It is our desire that the Third Edition of the Energy Reference Handbook will be of use to a broad audience in the new fields of energy and technology and, with its use, will provide a greater understanding of various words, procedures and theories. Most important, it is hoped that persons engaged in one area of energy will be made aware of the terminology of other areas of energy. Since the expanding need of technology in solving energy problems increases almost daily, proper communication within these areas is essential. We sincerely hope that our efforts will make some small contribution to solving the world's energy problems.

## SOURCE MATERIAL FOR GLOSSARY

- A      Arbuckle, et. al., Environmental Law Handbook, 6th ed., Government Institutes, Inc., Washington, DC, 1979.
- B      Lewis, R.S. and Spinrad, B. I., eds., The Energy Crisis, Educational Foundation for Nuclear Science, Chicago, IL, 1972.
- C      Lovins, Armory B., Soft Energy Paths, Friends of the Earth International, 1977. Reprinted with permission from Ballinger Publishing Company.
- D      Thrush, Paul W. and Bureau of Mines Staff, Eds., Dictionary of Mining, Mineral and Related Terms, revised ed., U.S. Department of Interior, U.S. Government Printing Office, Washington, DC, 1968.
- E      Common Environmental Terms - A Glossary, U.S. Environmental Protection Agency, Washington, DC, 1977.
- F      Conversion Factors Table, Engineering Standards, Phillips Petroleum Company, Bartlesville, OK, 1966.
- G      Energy Facts, Science Policy Research Division, Congressional Research Service, U.S. Government Printing Office, Washington, DC, 1973.
- H      A Floridian's Guide to Solar Energy, State of Florida Energy Office, Tallahassee, FL, 1975.
- I      Gas Facts - A Glossary, American Gas Association, Arlington, VA.

- J      Geothermal Energy: A National Proposal for Geothermal Resources Research, University of Alaska, U.S. Government Printing Office, Washington, DC, 1972.
- K      Glossary of Electric Utility Terms, Edison Electric Institute, New York, New York.
- L      Glossary of Important Power and Rate Terms, Abbreviations and Units of Measurement, Federal Power Commission, U.S. Government Printing Office, Washington, DC, 1965.
- M      Glossary of Terms Used in Petroleum and Refining, American Petroleum Institute, Washington, DC, 1962.
- N      Listing of Solar Radiation Measuring Equipment and Glossary, ERDA (under NASA contract), 1978.
- O      Nuclear Terms: A Glossary, U.S. Atomic Energy Commission, U.S. Government Printing Office, Washington, DC, 1974.
- P      The Shallow Land Burial of Low-Level Radioactively Contaminated Solid Waste, National Academy of Sciences, Washington, DC, 1976.
- Q      Solar Energy, A United Kingdom Assessment, UK Section of International Solar Energy Society, London, 1976.
- R      Solar Energy Utilization for Heating & Cooling, Chapter 59, 1974 Applications Handbook, National Science Foundation, U.S. Government Printing Office, Washington, DC, 1974.
- S      Solar Heating and Cooling Demonstration Program: A Descriptive Summary of HUD Cycle 2 Solar Residential Projects, HUD, (in co-operation with ERDA), U.S. Government Printing Office, Washington, DC, 1976.
- T      Wind Energy Systems: A Non-Pollutive, Non-Depletable Energy, Public Information Office, NASA Lewis Research Center, December 1973.



- U      Wind Machines, National Science Foundation, U.S. Government Printing Office, Washington, DC, 1975.
- V      "Factsheet #18," National Science Teachers Association, Alternate Energy Sources, A Glossary of Terms.
- W      Nuclear Terms: A Brief Glossary, U.S. Atomic Energy Commission booklet, 1974.
- X      Nuclear Power Issues and Choices, (Report of the Nuclear Policy Study Group).
- Y      Hall, Carl W., Dictionary of Drying, Marcel Dekker Publishers, New York, NY, 1979.
- Z      Science Council of Canada, Report #30, June, 1979.
- AA      Environmental Glossary, Government Institutes, Inc., 1980.
- BB      Field, Edwin M., Oil Burners, Theodore Audel Company, 1977.
- CC      Harrison, George R., The Conquest of Energy, Morrow Publishing Company, 1968.
- DD      Gas Facts - A Glossary, American Gas Association, Arlington, VA.
- EE      Wind Energy Systems: A Non-Pollutive, Non-Depletable Energy, Public Information Service, NASA Lewis Research Center, December 1973.
- FF      Hunt, V. Daniel, Energy Dictionary, Van Nostrand Reinhold Co, New York, NY, 1979.

# **GLOSSARY OF ENERGY TERMS**

## TABLE OF CONTENTS

Acknowledgements	iii
Preface	iv
Source Material for Glossary	viii
Glossary of Energy Terms	1
Appendix	263
Listing of Figures and Tables	265
Source Material for Figures and Tables	273
Figures and Tables	
Section 1: World Energy Overview	275
Section 2: Fossil Fuels	287
Oil/Tar Sands	291
Oil Shale	301
Coal	309
Gas	327
Section 3: Nuclear	337
Section 4: Renewables: Solar, Wind, Ocean Systems, Geothermal, Biomass, Hydro	345
Section 5: Miscellaneous	387
Section 6: Conversion Tables	395

# A

**AAAS**

American Association for the Advancement of Science.

**AAPG**

American Association of Petroleum Geologists.

**AAQS**

Ambient air quality standards.

**AAR**

Association of American Railroads, the trade association for the railroad industry.

**abatement**

The method of reducing the degree of intensity of pollution. E

**abrasion**

The wearing away by friction; the act of wearing by rubbing or friction, the chief agents being currents of water laden with sand and other rock debris and by glaciers. D

**abrasion drilling**

An oil-drilling technique in which the use of abrasive material under pressure "cuts" the substrata, instead of using the conventional drill steam and bit. M

**absolute**

(1) In chemistry, free from impurity or admixture. (2) In physics, not dependent on any arbitrary standard. D

**absolute pressure**

Pressure measured with respect to zero pressure, as distinct from pressure measured with respect to some standard pressure. An example of such a standard pressure is atmospheric pressure (30 lb pressure psi is equivalent to 44.7 lb pressure psia). M

**absolute temperature**

Temperature at which zero is a condition absolutely free of heat and equivalent to  $-459.72^{\circ}\text{F}$  or  $-273.18^{\circ}\text{C}$ . To convert temperatures on Fahrenheit or Centigrade scales to degrees absolute, add 459.72 or 273.18, respectively. M

**absolute viscosity**

The force which will move 1 sq cm of plane surface with a speed of 1 cm per sec relative to another parallel plane surface from which it is separated by a layer of liquid 1 cm thick. This viscosity is expressed in dynes per sq cm, its unit being the poise, which is equal to 1 dyne-sec per sq cm. A unit of one-hundredth of a poise, designated as a centipoise, is more convenient and is commonly used. M

**absolute zero**

A point which has been determined on the thermometer scale (by theoretical considerations), beyond this a further decrease in temperature is inconceivable. It is that temperature at which the volume of a gas would have become zero or it would have lost all the molecular vibration which manifests itself as heat. The temperature of absolute zero is  $-459.72^{\circ}\text{F}$  or  $-273.18^{\circ}\text{C}$ . BB

**absorbed dose**

When ionizing radiation passes through matter, some of its energy is imparted to the matter. The amount absorbed per unit mass of irradiated material is called the absorbed dose, and is measured in rems and rads. W

**absorber**

Any material that absorbs or diminishes the intensity of ionizing radiation. Neutron absorbers, like boron, hafnium and cadmium are used in control rods for reactors. Concrete and steel absorb gamma rays and neutrons in reactor shields. A thin sheet of paper or metal will absorb or attenuate alpha particles and all except the most energetic beta particles. W

**absorbite**

The trade name for activated charcoal. D

**absorptiometer**

A device for measuring the solubility of a gas in a liquid. D

**absorption**

(1) The process by which one substance draws into itself another substance. Example: a sponge picking up water. (2) In solar energy, the process in which incident radiant energy is retained by a substance. N

**absorption gasoline**

Gasoline extracted from natural gas or refinery gas, e.g., by contacting the

absorbed gas with an oil and subsequently distilling the gasoline from the heavier oil. M

**absorption loss**

(1) The loss of water occurring during initial filling of a reservoir in wetting rocks and soil. (2) That part of the transmission loss which is due to the dissipation or the conversion of sound energy into some other form of energy, usually heat. D

**absorption oil**

An oil used to separate the heavier components from a vapor mixture by absorption of the heavier components during intimate contacting of the oil and vapor. It is used in recovering gasoline from wet gas. M

**absorptivity**

The ratio of the radiant energy absorbed by a body to that falling upon it. It is equal to the emissivity for radiation of the same wavelength. D

**ac**

Alternating current.

**accelerated weathering test**

A test to indicate the effect of weather on coal, in which the coal is alternately exposed to freezing, wetting, warming, and light. D

**accelerator**

A device for increasing the velocity and energy of charged elementary particles; for example, electrons or protons, through application of electrical and/or magnetic forces. Accelerators have made particles move at velocities approaching the speed of light. Types of accelerators include betatrons, Cockcroft-Walton accelerators, cyclotrons, linear accelerators, synchrocyclotrons, synchrotrons, Van de Graff generators and others. D

**accelerometer (acceleration pickup)**

An electroacoustic transducer that responds to the acceleration of the

surface to which the transducer is attached, and delivers essentially equivalent electric waves. E

**acceptor levels**

Energy levels formed within the energy gap by a deficiency of electrons. D

**acclimation**

The physiological and behavioral adjustments of an organism to changes in its immediate environment. E

**ACES**

Annual cycle energy systems.

**Acheson furnace**

A resistance-type furnace for the production of silicon carbide and synthetic graphite. D

**acid**

(1) A compound that dissociates in a water solution to furnish hydrogen ions. (2) Having acid-forming constituents present in excess of the proportion required to form a neutral or normal compound. D

**acid clay**

A naturally occurring clay which, after evaluation, usually with acid, is used mainly as a decolorant or refining agent, and sometimes as a desulfurizer, coagulant, or catalyst. D

**acid fracture**

Treatment combining physical and chemical agencies to improve permeability of sand-carbonate reservoirs.

**acidizing**

A process of pumping acid directly into the producing oil well. When it reaches the producing formation, the acid reacts with certain materials in the reservoir rock, etching out channels through which the oil and gas can flow toward the well bore. Hydrochloric acid in a modified form is most frequently used. The process allows

trapped oil and gas to move toward the well bore. M

**acid mine drainage**

Acidic drainage from bituminous coal mines containing a high concentration of acidic sulfates, especially ferrous sulfate. D

**ACIL**

American Council of Independent Laboratories.

**acoustical absorptivity**

The ratio of the sound energy absorbed by a surface to that incident upon it. D

**accoustical privacy**

(1) The science of sound, including the generation, transmission and effects of sound waves, both audible and inaudible. (2) The acoustics of an auditorium or of a room, the totality of those physical qualities (such as size, shape, amount of sound absorption, and amount of noise) which determine the audibility and perception of speech and music. E

**acre**

A measure of surficial area, usually of land. The statute acre of the U.S. and England contains 43,560 square feet (4,840 square yards or 160 square rods); abbreviation, a. D

**acre-foot**

A quantity of water that would cover 1 acre, 1 foot deep. Contains 43,560 cubic feet, 1,233 cubic meters, 32,580 gallons (U.S.). One acre-foot of water can satisfy the municipal and industrial energy demands of four people for 1 year. G

**acrometer**

An instrument for determining the density of gases. D

**ACRS**

Advisory Committee on Reactor Safeguards.

**ACS**

American Chemical Society.

**actinides**

A group name for the radioactive series of heavy elements starting with the element actinium of atomic number 89, and continuing to element 103, lawrencium. The name is taken from actinium, the first member of the series. Z

**activated sludge**

Sediment waste that has been aerated and subjected to bacterial action to remove organic matter. E

**activation**

The process of making a material radioactive by bombardment with neutrons, protons, or other nuclear particles. Also called radioactivation. O

**activation energy**

The energy that molecules must acquire in order to react. M

**active solar system**

A solar system in which an energy resource, in addition to solar, is used for the transfer of thermal energy. This additional energy, generated on or off the site, is required for pumps, blowers, or other heat transfer medium moving devices necessary for system operation. S

**activity**

A measure of the rate at which a material is emitting nuclear radiations; usually given in terms of the number of nuclear disintegrations occurring in a given quantity of material over a unit of time; the standard unit of activity is the curie, which is equal to  $3.7 \times 10^{10}$  disintegrations per second. P

**acute radiation sickness syndrome**

An acute organic disorder that follows exposure to relatively severe doses of

ionizing radiation. It is characterized by nausea, vomiting, diarrhea, blood cell changes, and in later stages by hemorrhage and loss of hair. W

**adaptation**

A change in structure or habit of an organism that produces better adjustment to the environment. E

**additive**

An agent used for imparting new, or for improving existing, characteristics of oils. M

**adiabatic**

Referring to a temperature change that does not involve an exchange of heat with the surroundings, warming by compression, cooling by expansion. E

**adiabatic compression**

Compression in which no heat is added to or subtracted from the air and the internal energy of the air is increased by an amount equivalent to the external work done on the air. The increase in temperature of the air during adiabatic compression tends to increase the pressure on account of the decrease in volume alone; therefore, the pressure during adiabatic compression rises faster than the volume diminishes. D

**ADP**

Atmospheric dew point or automatic data processing.

**adsorption**

The adhesion of the molecules of gases or dissolved substances to the surface of solid bodies, resulting in relatively high concentration of the gas or solution at the place of contact. In the oil industry: a separation process, similar to solvent extraction, in oil refining. A solid solvent is used which must be porous in order to adsorb, or hold, the undesired petroleum components on its surface. M

**adsorption gasoline**

Natural gasoline obtained by the adsorption process, adsorbed from wet gas by activated carbon or charcoal. M

**adsorption water**

Water held on the surface of solid particles by molecular forces with emission of heat (heat of wetting). E

**AEC**

Atomic Energy Commission.

**AEE**

Association of Energy Engineers (no longer exists; it was absorbed into ERDA which was then absorbed into the U.S. DOE).

**aeolian**

See eolian.

**aeration**

The process of being supplied or impregnated with air. Aeration is used in waste water treatment to foster biological and chemical purification. E

**aeration cell**

An electrolytic cell, the electromotive force which is due to a difference in air (oxygen) concentration at one electrode as compared with that at another electrode of the same material. Also called oxygen cell. D

**aerobic**

Refers to life or processes that can occur only in the presence of oxygen. A

**aerosol**

A dispersion of solid or liquid particles of microscopic size in gaseous media, such as smoke, fog, or mist. E

**aerosphere**

The atmosphere considered as a spherical shell of gases surrounding the earth. E

**AFB**

Atmospheric fluidized bed.

**AFDC**

Allowable funds used during construction.

**afterburner**

(1) An air pollution abatement device that removes undesirable organic gases through incineration. (2) A ramjet coupled to a jet engine to provide additional power. E

**afterheat**

The heat produced by the continuing decay of radioactive atoms in a nuclear reactor after the fission chain reaction has ceased. Most of the afterheat is due to the decay of fission products. D

**AF/Y**

Acre foot/year.

**AGA**

American Gas Association.

**aggregate**

(1) To bring together; to collect or to gather into a mass. It can be sand, gravel, or any clastic material in a bedded iron ore, sometimes so abundant as to make it resemble a pudding-stone. (2) Uncrushed gravel, crushed stone or rock, sand, or artificially produced inorganic materials, which form the major part of concrete. D

**agricultural geology; agrogeology**

The application of geology to agricultural problems and to soil improvement. D

**AHAM**

Association of Home Appliance Manufacturers.

**AIChe**

American Institute of Chemical Engineers.

**AIF**

Atomic Industrial Forum.



**AIME**

American Institute of Mining Engineers. American Institute of Mining, Metallurgical and Petroleum Engineers.

**air**

The mixture of gases that surrounds the earth and forms its atmosphere; composed by volume of 21 percent oxygen and 78 percent nitrogen; by weight about 23 percent oxygen and 77 percent nitrogen. It also contains about 0.03 percent carbon dioxide, some aqueous vapor, and some argon. D

**air-blown asphalt**

Asphalt produced by blowing air through residual oils or similar mineral oil products at moderately elevated temperatures. M

**airborne pollutants**

Pollutants may be classified as: (1) airborne particulates, also known as aerosols, and (2) gases or vapors, including the permanent gases and those compounds having a boiling point below about 200°C. The aerosols are air suspensions, including dusts, smoke mists, and fumes. Vapors are gaseous materials derived from materials usually solid or liquid, such as gasoline. Gases and vapors will diffuse throughout the atmosphere. The more important gases are sulfur dioxide, hydrogen fluoride, chlorine, oxide of nitrogen, aldehydes, carbon monoxide, and organic vapors. E

**air cleaning**

A coal cleaning method that utilizes air tables to remove the dust and waste from coal. Air cleaning requires that the coal contain less than 5% of surface moisture as a rule. It is effective only in the coarsest sizes (plus 10 to 28 mesh) and is best suited to coals having a sharply defined line between coal and refuse material. It is a less expensive and also a less

accurate method of cleaning coal than the wet cleaning method. D

**air conditioning**

The simultaneous control, within prescribed limits, of the quality, quantity, and temperature-humidity of the air in a designated area. It is essentially atmospheric environmental control. D

**air curtain**

(1) A method for mechanical containment of oil spills. Air is bubbled through a perforated pipe causing an upward water flow that retards the spreading of oil. (2) Used as a barrier to prevent fish from entering a polluted body of water. E

**airbox**

A system for breaking down coal by which compressed air, generated locally by a portable compressor at 10,000 pounds per square inch, is used in a releasing cyclinder, which is placed in a hole drilled in the coal. Thus, slow breaking results, with no flame, in producing a larger amount of lump coal than by explosives. D

**air gas**

A combustible gas made by charging air with the vapor of some volatile hydrocarbon mixture (as gasoline) and used for lighting and heating. D

**air horsepower**

The rate at which energy is used in horsepower units, in moving air between points. D

**air mass**

A widespread body of air with properties that were established while the air was situated over a particular region of the earth's surface and that undergoes specific modifications while in transit away from that region. E

**air pollution**

The presence of contaminants in the air in concentrations that prevent the