

Appendix C

Conversion Factors, Abbreviations, and Glossary

Conversion Factors

Area

1 square kilometer (km²)=
0.386 square mile
247 acres
100 hectares

1 square mile=
2.59 square kilometers (km²)
6.4x10² acres
2.59x10² hectares

1 acre=
0.405 hectare (ha)
1.56x10⁻³ square miles
4.05 square kilometers (km²)

1 hectare=
0.01 square kilometer (km²)
3.86x10⁻³ square miles
2.47 acres

Weight

1 kilogram (kg)=
2.20 pounds (lb)
1 pound (lb)=
0.454 kilogram (kg)

1 metric ton (ret) (or "long ton")=
1,000 kilograms or 2,200 lbs
1 short ton=
2,000 pounds or 907 kg

Energy

1 quad (quadrillion Btu)=
1.05x 10¹⁸ Joules (J)
1.05 exajoules (EJ)
3.60x10³ metric tons, coal
1.72x 10⁶ barrels, oil
2.36x10³ metric tons, oil
2.83x10¹⁰ cubic meters, gas
1.07x10¹² cubic feet, gas
2.93x 10² terawatt hours

1 kilowatthour=
3.41x 10³ British thermal units (Btu)
3.6x10⁶ Joules (J)

1 Joule=
9.48x10⁻⁷ British thermal unit (Btu)
2.78x10⁻⁷ kilowatthours (kWh)

1 British thermal unit (Btu)=
2.93x 10⁴ kilowatthours (kWh)
1.05x10³ Joules (J)

Volume

1 liter (l)=
2.64x10⁻³ gallons (liquid, U. S.)
6.29x10⁻³ barrels (petroleum, U. S.)
1x10⁻³ cubic meters (m³)
3.53x10⁻² cubic feet (ft³)

1 gallon (liquid, U.S.)=
3.78 liters (l)
2.38x10⁻² barrels (petroleum, U. S.)
3.78x10⁻³ cubic meter (m³)
1.33x10⁻¹ cubic feet (ft³)

1 barrel (bbl) (petroleum, U.S.)=
1.59x10² liters (l)
42 gallons (liquid, U. S.)
1.59x10⁻¹ cubic meters (m³)
5.61 cubic feet (ft³)

1 cubic meter (m³)=
1x10³ liters (l)
2.64x10³ gallons (liquid, U. S.)
6.29 barrels (petroleum, U. S.)
35.3 cubic feet (ft³)

1 cubic foot (ft³)=
2.83x10¹ liters (l)
7.48 gallons (liquid, U. S.)
1.78x10⁻¹ barrels (petroleum, U. S.)
2.83x10⁻² cubic meters (m³)

1 cord wood=
128 cubic feet (ft³) stacked wood
3.62 cubic meters (m³) stacked wood
1 dry (i.e., no moisture) ton of wood

Temperature

From Centigrade to Fahrenheit:
 $((9/5) \times (C)) + 32 = ^\circ F$

From Fahrenheit to Centigrade:
 $(5/9) \times (oF - 32) = ^\circ C$

Temperature changes:

—To convert a Centigrade change to a Fahrenheit change:
 $9/5 \times (\text{change in } ^\circ C) = \text{change in } ^\circ F$

—To convert a Fahrenheit change to a Centigrade change:
 $5/9 \times (\text{change in } ^\circ F) = \text{change in } ^\circ C$

—Example: a 3.0 °C rise in temperature = a 5.4 OF rise in temperature

Abbreviations

AC	—Alternating current
ACEEE	—American Council for an Energy Efficient Economy
ADB	—Asian Development Bank
ADF	—African Development Foundation
<i>AFC</i>	—Atmospheric fluidized bed combustion
AfDB	—African Development Bank
AfDF	—African Development Fund
AID	—Agency for International Development
ASD	—Adjustable speed drive
ASEAN	—Association of South East Asian Nations
ASHRAE	—American Society of Heating, Refrigeration and Air-Conditioning Engineers
ASTRA	—Centre for the Application of Science and Technology to Rural Areas
BEST	—Biomass Energy Systems and Technology (AID)
BIG/GT	—Biomass gasifier/gas turbines
BOF	—Basic oxygen furnace
BOS	—Balance-of-system
Btu	—British thermal unit
CAEX	—Computer aided exploration and development
<i>CAFE</i>	—Corporate average fuel efficiency
CEST	—Condensing-extraction steam Turbine
CETA	—Conventional Energy Technical Assistance (AID)
CFCs	—Chlorofluorocarbons
CGIAR	—Consultative Group on International Agricultural Research
CH ₄	—Methane
CKD	—Completely knocked down kits
CNG	—Compressed Natural Gas
CO*	—Carbon dioxide
CORECT	—Committee on Renewable Energy Commerce and Trade
DC	—Direct current
DOE	—Department of Energy
DRI	—Directly reduced iron
DSM	—Demand side management
EAF	—Electric arc furnace
EAI	—Enterprise for the Americas Initiative
EDI	—Economic Development Institute (World Bank)
EPA	—Environmental Protection Agency
EPDCP	—Energy Policy Development and Conservation Project (AID)
EPRI	—Electric Power Research Institute
<i>ESCO</i>	—Energy service companies
ESMAP	—Energy Sector Management Assistance Program
ETIP	—Energy Technology Innovation Project (AID)
Eximbank	—Export-Import Bank
FAO	—Food and Agriculture Organization
<i>FBC</i>	—Fluidized bed combustion

International System of Units (SI): Prefixes

Prefix	SI symbol	Multiplication factor
exa	E	10 ¹⁸ (1,000,000,000,000,000,000)
peta	P	10 ¹⁵ (1,000,000,000,000,000)
tera	T	10 ¹² (1,000,000,000,000)
giga	G	10 ⁹ (1,000,000,000)
mega	M	10 ⁶ (1,000,000)
kilo	k	10 ³ (1,000)
hecto	h	10 ² (100)
deca	da	10

EXAMPLES: 1 Teragram or Tg (10¹² or 1,000,000,000,000 or 1 trillion grams); 1 megawatt-electric or MWe (10⁶ or 1,000,000 or 1 million watts-electric).

EXCEPTION: 10¹⁵ (1,000,000,000,000,000) British thermal units (Btu) is not generally referred to as a Pbtu. Instead it is known as a quad, or one quadrillion Btu's.

FCIA	—Foreign Credit Insurance Association
FGD	—Flue gas desulfurization
FINESSE	—Financing of Energy Services for Small Scale Energy Users
GAO	--General Accounting Office
GATT	-General Agreement on Tariffs and Trade
GDP	-Gross domestic product
GEEI	-Global Energy Efficiency Initiative
GEF	--Global Environmental Facility
GNP	-Gross national product
HVAC	—Heating, ventilation, air-conditioning equipment
IAF	—Inter-American Foundation
IBRD	—International Bank for Reconstruction and Development
IDA	—International Development Association
IDB	—Inter-American Development Bank
IEA	—International Energy Agency
<i>IFC</i>	—International Finance Corporation
<i>IGCC</i>	—Integrated gasification combined cycle
<i>IIEC</i>	—International Institute for Energy Conservation
<i>IPCC</i>	—Intergovernmental Panel on Climate Change
ISTIG	—Intercooled steam injected gas turbine
JIT	—Just-in-time (inventory control)
LCP	—Least cost planning
LDC	—Lesser developed country
LPG	—Liquefied petroleum gas
LWR	—Light water reactor
MAGPI	—Multi-Agency Group for Power Sector Innovation
MDB	—Multilateral development bank
MFN	—Most favored nation
MIGA	—Multilateral Investment Guarantee Agency
MWD	—Measurement while drilling
NGL	—Natural gas liquids
NGO	—Non-governmental organization
<i>NIC</i>	—Newly industrializing country
O&M	—Operations and maintenance
ODA	-Overseas Development Assistance

OECD	-Organization for Economic Cooperation and Development
OIMP	-Office of International Major Projects (Dept of Commerce)
OPEC	-Organization of Petroleum Exporting Countries
OPIC	—Overseas Private Investment Corporation
PACER	—Program for the Acceleration of Commercial Energy Research (AID)
PC	—Pulverized coal
PEFCO	— Private Export Funding Corporation
PPP	—Purchasing power parity
PROCEL	—National Electricity Conservation Program (Brazil)
PSED	— Private Sector Energy Development (AID)
PURPA	—Public Utilities Regulatory Policy Act
PV	—Photovoltaic
PVO	—Private volunteer organizations
R&D	—Research and development
RD&D	—Research, development and demonstration
REAT	—Renewable Energy Applications and Training (AID)
REDAC	—Renewable Energy Design Assistance Center (SANDIA)
SRIC	—Short rotation intensive culture
STIG	—Steam injected gas turbine
T&D	—Transmission and distribution
TDP	—Trade and Development Program
UHP	—Ultra high power furnace
UNDP	—United Nations Development program
UNEP	—United Nations Environment Program
UNFPA	—United Nations Family Planning Association
UNIDO	—United Nations Industrial Development Organization
USDA	—United States Department of Agriculture
US/ECRE	—United States Export Council for Renewable Energy
US&FCS	—United States and Foreign Commercial Service
USTR	—United States Trade Representative
VHF/FM	—Very high frequency/frequency modulated
WB	—World Bank

Glossary

Appliance: Any household energy-using device.

Biodiversity: Biological diversity, i.e., the variety of species in a given area.

Biomass: Technically, the total dry organic matter or stored energy content of living organisms in a given area. As used by OTA, biomass refers to forms of living matter (e.g., grasses, trees, shrubs, agricultural and forest residues) or their derivatives (e.g., ethanol, timber, charcoal, dung) that can be used as a fuel.

Btu (British thermal unit): The amount of heat needed to raise the temperature of 1 pound of water by 10F at a specified temperature.

Capacity factor: The actual output of the generating technology in kWh, divided by the theoretical maximum output of the technology operating at peak design resource levels.

Capital cost: The investment in plant and equipment. This includes construction costs, but does not include operations, maintenance, or fuel/electricity costs.

Chlorofluorocarbons: Compounds containing chlorine, fluorine, and carbon; they generally are used as propellants, refrigerants, blowing agents (for producing foam), and solvents. They are identified with numbered suffixes (e.g., CFC-11, CFC-12). They are known to react with and deplete stratospheric ozone and also are “greenhouse” gases in that they effectively absorb certain types of radiation in the atmosphere.

Cogeneration: The simultaneous production of both electric power and heat for use in industrial or commercial/residential or other applications.

Commercial energy: Usually refers to coal, oil, gas, and electricity on the basis that they are widely traded in organized markets. These fuels are distinguished from other fuels such as firewood, charcoal, and animal and crop wastes, which are mostly described as ‘biomass’ in this report.

Deforestation: Converting forest land to other vegetation or uses (i.e., cropland, pasture, dams).

Demand side management: The planning, implementation, and monitoring of utility activities designed to encourage customers to modify their pattern of electricity usage.

Discount rate: The rate at which money grows in value (relative to inflation) if it is invested.

Efficiency: For electricity generating technologies, efficiency is the actual output in kWh divided by the energy consumed or used to produce that output. For end use technologies, efficiency is often defined as the ratio of output to input, but for some end uses (such as transportation), more complex definitions are used.

Emissions: Flows of gases, liquid droplets, or solid particles into the atmosphere. Gross emissions from a specific source are the total quantity released. Net emissions are gross emissions minus flows back to the original source. Plants, for example, take carbon from the atmosphere and store it as biomass during photosynthesis, and they release it during respiration, when they decompose, or when they are burned.

End use: Any of the services or processes (e.g., lighting, refrigerant ion, mechanical drive) made possible through the provision of energy (also see energy services).

Energy carrier: A fuel-liquid, gaseous, or solid-or electricity to provide energy.

Energy conversion: The process of converting energy from one form to another. Often involves transforming primary or raw energy to a high quality carrier, such as gas or electricity.

Energy intensity: The amount of energy required per unit of a particular product or activity. Often used interchangeably with “energy per dollar of GNP.”

Energy services: The service or end use ultimately provided by energy. For example, in a home with an electric heat pump, the service provided by electricity is not to drive the heat pump’s electric motor but rather to provide comfortable conditions inside the house (also see end use).

Feedback: When one variable in a system (e.g., increasing temperature) triggers changes in a second variable (e.g., cloud cover) which in turn ultimately affect the original variable (i.e., augmenting or diminishing the warming). A positive feedback intensifies the effect. A negative feedback reduces the effect.

Fossil fuel: Coal, petroleum, or natural gas or any fuel derived from them.

Generating capacity: The capacity of a powerplant to generate electricity, typically expressed in watts-electric (e.g., kWe or MWe).

Greenhouse effect: The effect produced as certain atmospheric gases allow incoming solar radiation to pass through to the Earth’s surface, but prevent the (infrared) radiation, which is reradiated from the Earth, from escaping into outer space. The effect responsible for warming the planet.

Greenhouse gas: Any gas that absorbs infrared radiation in the atmosphere.

Integrated Resource Planning (IRP): In energy planning, a cost-based ranking of all of the supply and end use technologies that could provide an energy service, beginning implementation with the lowest cost opportunities. Integrated Resource Planning changes the regulatory framework in order to encourage utilities and others to implement the least-cost demand and supply options. Among other changes, regulators allow utilities to earn income based on the net benefits from investments in energy efficiency improvements,

Least cost planning: Often used interchangeably with Integrated Resource Planning, though a more limited

frame of reference. The practice of basing investment decisions on the least costly option for providing energy services. It is distinguished from the more traditional approach taken by utilities, which focuses on the least costly ways to provide specific types of energy, with little or no consideration of less costly alternatives.

Life cycle or lifecycle operating cost: The cost of a good or service over its entire life cycle.

Methane: A compound consisting of one carbon atom and four hydrogen atoms; it occurs naturally, often in association with coal and petroleum and as a byproduct of the metabolic activities of some microorganisms; it can also be synthesized artificially.

Monoculture: The exclusive cultivation of single species (e.g., corn or soybeans), a common practice in modern agriculture and energy forestry.

Natural gas: A naturally occurring mixture of hydrocarbons (principally methane) and small quantities of other gases found in porous geological formations, often in association with petroleum.

OECD: Organization for Economic Cooperation and Development, an organization that includes most of the world’s industrialized market economies. Members include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

Primary energy: The term “primary energy” includes fossil fuels (e.g., coal, crude oil, gas) and biomass in their crude or raw state before processing into a form suitable for use by consumers.

Reliability: Measured by the actual output of the generating technology in kWh, divided by the output that would occur if the technology worked perfectly all the time. As used in this report, reliability does not reflect resource limits. The term **availability** is also used.

Reserves: The portion of a resource base that is proven to exist and can be economically recovered (i.e., the value of the product exceeds the production and transportation costs).

Residues: Agricultural or agroindustrial byproducts (e.g., sawdust, coconut shell, bagasse from sugar cane) that can be used as fuel.

Resources: The total existing stock of a given resource—including discovered and not yet discovered portions—regardless of the economic feasibility of recovering the resource. Also refers to subset of resources that have been proven to a degree of certainty, which are likely

to be proved recoverable in the future based on a defined set of technical and economic specifications.

Retrofit: To update an existing structure or technology by modifying it, as opposed to creating something entirely new from scratch. For example, an old house can be retrofitted with advanced windows or insulation to slow the flow of heat energy into or from the house.

Sectors: Categories of end users or suppliers. The sectors included in this report are residential, commercial, industrial, agricultural, transportation, conversion, and resources.

Sustainable: A term used to characterize human activities that can be undertaken in such a manner as to not adversely affect the environmental conditions (e.g., soil, water quality, climate) necessary to support those same activities in the future.

Systemwide: In the context of this report, an analytic point of view that accounts for each interdependent

aspect of the process of producing, providing and using energy.

Traditional energy: Typically, fuels that are gathered and burned by individuals with little or no processing. Some processed forms, such as charcoal, are included in this definition.

Transport mode: The different means of transporting people and freight within a system. This includes, road, rail, and maritime transport.

Watt (W): A common unit used in measuring power (i.e., as the flow of energy overtime), equivalent to 3.41 Btu per hour. Where an ‘e’ follows the unit (as in kWe or MWe), the watt is in the form of electrical energy. Where a ‘t’ follows the unit (as in kWt or MWt), the watt is in the form of thermal energy.