普通高等教育规划教材

能源英语 1

Energy English 1

赵明学　杨晓华　周英莉/ 编著

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全国百佳图书出版单位

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本书受中国矿业大学（北京）“越崎”系列教材建设资助

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图书在版编目（CIP）数据

能源英语 1/赵明学，杨晓华，周英莉编著．—北京：知识产权出版社，2016.8
ISBN 978-7-5130-3110-3

Ⅰ．①能…　Ⅱ．①赵…②杨…③周…　Ⅲ．①能源—英语　Ⅳ．①H31

中国版本图书馆 CIP 数据核字（2014）第 248497 号

内容提要

本书分为传统能源和新能源两部分。传统能源部分介绍了煤、石油、天然气、水能和核能。传统能源的大规模工业化利用历史较长，开采、加工、运输、储存和利用技术成熟。但传统能源中除水能外均是不可再生的，其中煤和石油已带来严重的环境污染。新能源部分介绍了太阳能、风能、生物能、地热能、海洋能和氢能。传统能源带来的能源危机和环境破坏使新能源备受关注，虽然在全球能源供给总量中的比例很小，但发展迅速，尤其是太阳能和风能。

编写此书是为了让学习者了解能源、关注能源、正确看待能源问题，在建立能源知识构架、掌握相关英语表达的同时，形成节能意识，爱护我们赖以生存的地球。

责任编辑：陈晶晶　　**责任出版：**孙婷婷

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出版发行：知识产权出版社有限责任公司　　**网　　址：**http://www.ipph.cn
社　　址：北京市海淀区西外太平庄 55 号　　**邮　　编：**100081
责编电话：010-82000860 转 8391　　**责编邮箱：**shiny-chjj@163.com
发行电话：010-82000860 转 8101/8102　　**发行传真：**010-82000893/82005070/82000270
印　　刷：北京中献拓方科技发展有限公司　　**经　　销：**各大网上书店、新华书店及相关专业书店
开　　本：720mm×960mm　1/16　　**印　　张：**15.5
版　　次：2016 年 8 月第 1 版　　**印　　次：**2016 年 8 月第 1 次印刷
字　　数：240 千字　　**定　　价：**45.00 元
ISBN 978-7-5130-3110-3

Contents

1 Energy Introduction

Any activity requires energy. Human's life will perish without energy to sustain. The amount of energy for a person's survival is 0.5lit. of oil equivalent①, but the actual amount of individual energy consumption in daily life is 9.3lit. of oil equivalent, ensuring various needs, such as cooking, cooling and heating houses and commuting to work or school.

1.1 History of Energy Utilization

Human's utilization of energy involves three phases—manual and animal labor age, mechanical age and electric age. Initially, human and animals acquired energy through food intake. Manual and animal labor was the approach to accomplishing human beings' activities. Then in 1785 the industrial revolution occurred and a mechanical age started. The invention of the steam engine by James Watt of Scotland symbolized this revolution. Steam replaced manual and animal labor and was widely used in the industry. The appearance of internal combustion engine② in the late 19th century further accelerated the trend. In 1888, the invention of the commercial induction motor③ by Nicola Tesla and the commercial availability of electrical power started the new electrical age. Application of machines and electricity accelerated energy requirement. Now energy is so crucial to modern society and human civilization.

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① oil equivalent n. phr. 油当量。按标准油的热值计算各种能源量的换算指标，1千克油当量的热值，联合国按42.62兆焦（MJ）计算。

② internal combustion engine n. phr. 内燃机

③ induction motor n. phr. 感应电动机

In this process, coal started the industrial revolution in Britain and promoted the revolution worldwide. Petroleum laid the foundation for the world economy after the Second World War. It can be said that energy is the basis of economic growth and world development.

Here the importance of petroleum should be mentioned again because it contributed a lot to the development of new energy sources, such as solar energy, wind energy, biomass energy①, etc. 1973 is a crucial year when the oil shock② happened and influenced energy security. Before 1973, petroleum powered the world as a secure and cheap fuel and the world economy developed rapidly. In October of that year, Organization of Petrol Exportation Countries③ (OPEC) put an embargo on oil production and started the oil-pricing control strategy. The oil prices surged four times, causing a severe energy crisis the world over and bringing an end to the era of ample and cheap oil. This energy crisis further incurred global inflation and became an economic crisis. For the first time, developing alternative energy sources became an urgent issue for governments of all countries. The second "oil shock" hit the world in 1979 because of sharp decline of output due to Iran revolution. By the end of 1980, the price of crude oil was 19 times what it had been just ten years earlier. The second oil shock again triggered the governments' panic of energy crisis. Consequently, more allocation from the governments and research promoted further development of alternative energy sources.

1.2 Energy Demand

Energy is not always affordable or accessible to all. Energy poverty is found in developed and less developed countries, in cities and countrysides.

Access to modern energy services is still low in developing countries and this lack of access disproportionately affects the least developed countries (LDCs).

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① biomass energy n. phr. 生物质能

② oil shock n. phr. 石油震荡

③ Organization of Petrol Exportation Countries n. phr. 石油输出国组织，成立于1960年。

Statistics from the UNDP/WHO① Report 2009 revealed the large gap between energy demand and energy supply. Three billion people still rely on solid fuels, traditional biomass and coal. Two million deaths annually are associated with the indoor burning of solid fuels in unventilated kitchens. About 44% of these deaths are children; and among adult deaths, 60% are women. Nearly a third of humanity has no access to modern energy services. One and half billion people are still living in darkness. To achieve universal energy access, the global community must take specific and far-reaching measures to massively scale up initiatives to expand access to modern energy services for the poor and un-served. Meanwhile, energy poverty exists even in developed countries. In the cases of the United States and the UK, low income households and households on tenant basis are usually fuel-poor. They have, on average, less efficient houses and the elderly are more likely to be energy-poor.

According to the World Energy Outlook② 2008, cities consumed two thirds of global energy in 2006. This proportion is expected to grow to almost three quarters by 2030. Substantial energy is required to meet types of energy consumption, such as transport energy consumption, water supply, increasing demand of electricity by high-rise buildings, and higher demand of air-conditioning due to heat island effects in compact cities. Population growth in cities also implies higher absolute energy demand. In rural areas, more people suffer energy poverty. Some energy-poor households find it difficult or impossible to get access to electricity. Others may have access but be unable to afford available energy service to heat their houses in winter to acceptable temperature.

In the report by the United Nations' secretary-general's adversary group in 2010 on Energy and Sustainable Future, two issues were identified as priorities—improving energy access and strengthening energy efficiency. Expanding access to affordable and clean energy is critical for enabling sustainable development across much of the globe. [1]

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① UNDP/WHO n. abbr. United Nations Development Programme/World Health Organization, 联合国开发计划署/世界卫生组织。

② World Energy Outlook n. phr. 《世界能源展望》，是国际能源署（IEA）发布的年度报告。

1.3 Classification of Energy Sources

Energy sources can be classified in various aspects—origin, method of obtainment, usability①, long-term availability, property, commercial application and pollution to environment. The contents of the classifications are overlapped to some extent.

1. Based on origin

(a) Fossil fuel② energy (from coal, petroleum and natural gas)

(b) Nuclear energy

(c) Hydro energy③

(d) Solar energy

(e) Wind energy

(f) Biomass energy

(g) Geothermal energy④

(h) Ocean energy (from thermal, tide and wave, etc.)

(i) Hydrogen energy⑤

2. Based on method of energy obtainment

1) Primary energy sources⑥ (PESs)

Primary energy is an energy form embodied in nature and still not being subjected to any conversion or transformation process. [2] Primary energy sources can be non-renewable or renewable. These energy sources include coal, crude oil, natural gas, solar energy, wind energy, hydro energy, biomass energy, nuclear fuels, etc. These sources are generally in raw forms and generally cannot be used directly. They need processing and conversion to meet the requirement of the users in a usable form.

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① usability n. 可用性

② fossil fuel n. phr. 化石燃料

③ hydro energy n. phr. 水能

④ geothermal energy n. phr. 地热能

⑤ hydrogen energy n. phr. 氢能

⑥ primary energy source n. phr. 一次能源

2) Secondary energy sources

Secondary energy sources are obtained from primary energy sources and become available to a consumer after processing or transformation. They are high-qualified and easily used. Thus, they are also known as usable energy sources. Secondary energy sources include electricity, steam, hot water, coke, coal gas, hydrogen energy, etc.

3. Based on usability

This kind of classification is based on technological maturity of an energy source.

1) Conventional energy sources①

Conventional energy sources are traditionally utilized, technically matured, and are widely used in large-scale production, including fossil fuels, hydro energy and nuclear energy.

2) Non-conventional energy sources

Non-conventional energy sources are less developed than conventional energy sources or still in research. They are also known as new energy sources or alternative energy sources②, including solar energy, wind energy, biomass energy, geothermal energy, ocean energy and hydrogen energy.

4. Based on long-term availability

1) Renewable energy sources

The supply of renewable energy sources is not reduced by human's consumption and renewed by nature. They are hydro energy, solar energy, wind energy, biomass energy, geothermal energy, ocean energy.

2) Non-renewable energy sources

Non-renewable energy sources are finite and their formation requires millions of years, which means they can not get supplement after being consumed and confront the risk of depletion. They are fossil fuels and uranium.

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① conventional energy source n. phr. 传统能源，常规能源

② alternative energy source n. phr. 替代能源

5. Based on properties

1) Energy containing sources①

This form of energy sources are materials providing energy. They can be stored and transported directly, such as fossil fuels, wood, nuclear fuels, hydrogen, etc.

2) Process energy sources②

They provide energy in the process of physical movement of materials, such as electricity, hydro energy, wind energy, tidal energy, wave energy, direct solar radiation, etc.

6. Based on commercial application

1) Commercial energy sources

The secondary usable energy sources are classified as commercial energy sources because they are essentially harnessed in commercial activities. Electricity, petrol③, diesel④, natural gas, etc. belong to this category.

2) Non-commercial energy sources

Non-commercial energy sources are those collected by individuals in nature and directly used without commercial operation. Wood, animal dung cake, crop residue, etc. are categorized as non-commercial and are typically used in rural areas.

7. Based on pollution to the environment

1) Clean energy sources⑤

Clean energy sources are less or not contaminative to the environment. Solar energy, hydro energy, ocean energy, hydrogen energy, etc. belong to this form of energy sources.

2) Non-clean energy sources

Energy sources which are contaminative to the nature are known as non-clean energy sources. Coal and petroleum are the representatives of this form.

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① energy containing sources n. phr. 含能体能源

② process energy sources n. phr. 过程性能源

③ petrol n. 汽油

④ diesel n. 柴油

⑤ clean energy source n. phr. 清洁能源，洁净能源

1.4 Energy and Environment

Human's civilization is established on the generation and consumption of energy, while the two activities are accompanied by environmental degradation①. Conventional energy sources are cheaper, and more convenient to be delivered and stored than non-conventional ones, so they are universally available at present. Such as heat, carbon dioxide, carbon monoxide, nitrogen oxides②, sulfur oxides, ozone③ (O_3), heavy metals, particulate matters④, etc. These pollutants impair the self-cleaning capability of the environment, deteriorate its various recycles, such as water cycle, nitrogen cycle and carbon cycle, and disturb its ecological balance[3]. In a word, human interference has exceeded natural limits.

1.4.1 Global Warming

Global warming is closely associated with the greenhouse effect⑤, a physical property of the earth's atmosphere[4]. Solar radiation at the frequencies of visible radiation (visible light, i. e. short wave) largely passes through the atmosphere to warm the earth's surface, which then emits this energy at the lower frequencies of infrared thermal radiation⑥ (long wave)[5] to the space. Greenhouse gases⑦ (GHGs), including carbon dioxide (CO_2), methane⑧ (CH_4), nitrous oxide (N_2O)⑨, ozone, and water vapor, in the atmosphere make it absorb more infrared energy than it re-radiates to the space, resulting in a net warming of the

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① environmental degradation n. phr. 环境退化

② nitrogen oxides n. phr. 氮氧化物，包括 N_2O、NO、NO_2、N_2O_3 等，造成大气污染的主要是一氧化氮（NO）和二氧化氮（NO_2），因此环境学中的氮氧化物一般是这二者的总称。

③ ozone n. 臭氧

④ particulate matter n. phr. 颗粒物

⑤ greenhouse effect n. phr. 温室效应

⑥ infrared thermal radiation n. phr. 红外热辐射

⑦ greenhouse gas n. phr. 温室气体

⑧ methane n. 甲烷

⑨ nitrous oxide 氧化亚氮

earth-atmosphere system and rise of surface temperature. This is the "natural greenhouse effect". The earth's atmosphere system balances absorption of solar radiation by emission of infrared radiation to the space.[4] (Fig. 1.1) However, the increased anthropogenic① energy activities lead to further increase in the concentration② of greenhouse gases in the atmosphere. Excessively emitted CO_2 is the major contributor of global warming. CO_2 constitutes more than 50% of GHGs. The CO_2 emission from the developed countries accounts for more than 80% of the world total. Meanwhile, manmade matters like chlorofluorocarbons③ (CFCs), sulfur hexafluoride④, intensify the damage to the balance of absorption of solar radiation and emission of infrared radiation. As a result, those GHGs trap more infrared radiation in the earth's surface, leading to the "enhanced greenhouse effect"⑤.[6]

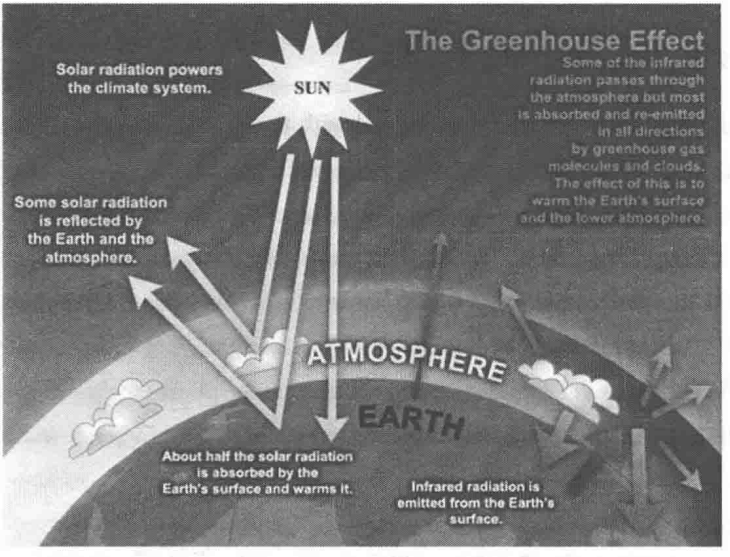

Fig 1.1[7]

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① anthropogenic a. 人为的

② concentration n. 浓度

③ chlorofluorocarbons n. 氟氯烃，又称氯氟烃，即氟利昂

④ sulfur hexafluoride n. phr. 六氟化硫，简称 SF_6。其是法国两位化学家 Moissan 和 Lebeau 于 1900 年合成的人造惰性气体，当前主要用于电力工业中。

⑤ enhanced greenhouse effect n. phr. 增强温室效应