“十三五”普通高等教育本科规划教材
新能源科学与工程系列教材

新能源科学与工程专业英语

李　洁　主　编
王砚帛　岳大为　副主编

中国电力出版社
CHINA ELECTRIC POWER PRESS

“十三五”普通高等教育本科规划教材
新能源科学与工程系列教材

新能源科学与工程专业英语

主　编　李　洁
副主编　王砚帛　岳大为
编　写　崔小逊　黄　雷　张家安
邓富金　高　志　苗　青
[illegible]　[illegible]　单泽萌
主　审　杨　鹏　王华君

中国电力出版社
CHINA ELECTRIC POWER PRESS

内 容 提 要

本书是为了满足高等院校新能源科学与工程及相关专业的“专业英语阅读”课程的需要而编写，针对新能源科学与工程的基础知识和新技术领域，合理安排知识结构布局，重点突出相关的电气与控制类内容。主要内容包括了新能源技术基础、新能源发电与控制技术、新能源发电并网技术、新能源存储和传输、新能源发展前沿等方面，涉及风能、太阳能、生物质能、氢能、核能、海洋能、地热能等。全书共分5个部分26个单元，每个部分开始有本部分内容简介，并推荐相关的视频网站，开拓读者视野；每个部分结束配有若干个Tips，加强读者的科技英语应用能力。同时每篇课文均配有重点词汇及长难句翻译，图文并茂，易于理解与掌握。

本书可作为高等院校新能源科学与工程专业本科生及研究生专业英语课程教材，也可供有关工程技术人员、对新能源有研究兴趣的英语爱好者学习参考。

图书在版编目（CIP）数据

新能源科学与工程专业英语/李洁主编．—北京：中国电力出版社，2017.11
“十三五”普通高等教育本科规划教材
ISBN 978-7-5198-0875-4

Ⅰ.①新… Ⅱ.①李… Ⅲ.①新能源—英语—高等学校—教材 Ⅳ.①TK01

中国版本图书馆CIP数据核字（2017）第220250号

出版发行：中国电力出版社
地　　址：北京市东城区北京站西街19号（邮政编码100005）
网　　址：http://www.cepp.sgcc.com.cn
责任编辑：王　娟　（010-63412522）
责任校对：马　宁
装帧设计：左　铭
责任印制：吴　迪

印　　刷：北京雁林吉兆印刷有限公司
版　　次：2017年11月第1版
印　　次：2017年11月北京第1次印刷
开　　本：787毫米×1092毫米　16开本
印　　张：15
字　　数：359千字
定　　价：38.00元

序

近年来，我国风力发电、太阳能光伏发电、生物质发电等新能源科学技术快速发展，引起世界瞩目，取得了一系列成就。但是与发达国家相比，我国新能源产业起步晚，新能源利用比例偏低，缺乏国内自主创新的核心技术，人才严重匮乏，发展新能源任务艰巨。2011 年，教育部批准设立战略性新兴产业相关本科专业“新能源科学与工程”专业，涉及风能、太阳能、生物质能、氢能、核电能等学科内容，培养在新能源领域从事科学技术应用、研究、开发和管理的高级人才。我们在专业设置，特别是教材建设还有很大的空间。“新能源科学与工程专业英语”作为拓宽学生的国际化视野、提高学生综合素质的必修课，也已列入本科生专业教学计划，对学生的成长成才会有重要作用。

本书的编者在查阅大量国内外资料和文献的基础上，针对新能源科学与工程专业的学科综合以及交叉的特点，全面系统地介绍了新能源的基础知识、发电及控制技术、新能源并网技术、新能源转换和储存技术、前沿新能源技术，构建出完整的新能源专业英语知识体系。同时，增设基础英语以及专业英语的实用要点，把训练语言技能与传授相关专业知识相结合，较好地处理了专业英语与公共英语的衔接问题。

本书突出了新能源科学与工程的专业特点，实用性强。同时，结构编排构思新颖，内容丰富，难度适中。期待本书可以对我国新能源科学与工程专业的人才培养、研究开发和科学普及等有所裨益。

孙鹤旭

2017 年 6 月

Preface

The development and utilization of new energy is the only way for mankind to meet the energy demand and solve environmental problems, and the 21st century is experiencing high speed developments of new energy technology revolution and industrialisation. As a theme of major worldwide developments, new energy technology involves many new and high-tech interdisciplinary interactions, including multiple areas: such as electricity, power, control, electronics, information, computer engineering, etc. At present, many universities have set up new energy technology courses in the engineering subject area, which would establish a good foundation for the development of a working force with high quality, creativity and satisfying the society demands.

Furthermore, with the increase of international exchanges and cooperation, the professional English capability in technical fields has already become a fundamental requirement and necessary skill of technical professionals, while new energy professional English is one of the preferred important subject areas in the field of new energy technology.

The book "New Energy Professional English Reading" is edited by Ms Li Jie, and written and compiled by a number of researches in new energy fields from both China and Denmark. The book presents a comprehensive introduction to the theory, new technology and practical applications of wind, solar, biomass, hydrogen, nuclear, geothermal energy, and ocean energy. With a limited space, the book elaborates systematically the aforementioned new energy technologies, especially in the areas of electrical engineering, control theory, and automation. It connects closely the new energy fundamentals with engineering practice and the contents are appropriately structured in such a modular way, including the basic knowledge, power generation and control, network connection, power transmission and energy storage, as well as the development trend. This presents a good attempt of the authors on introduction of the multidisciplinary interactive new energy technologies.

The book is at an appropriate level of complexity and suitable for a wide range of readers. It is my pleasure to recommend this book as an introductory reference for relevant students and researchers, engineering and technical professionals as well as for the people who wish to use English in new energy fields.

Zhe Chen

June, 2017

前　言

2011年，教育部批准设置“新能源科学与工程”专业，主要学习新能源的种类和特点、利用方式和方法，了解新能源的应用现状和未来的发展趋势。课程内容涉及风能、太阳能、生物质能、氢能、核电能等。新能源科学与工程专业英语作为本专业的必修课，列入本科生专业教学计划；新能源科学与工程专业有着学科综合以及交叉的特点，仅风力发电技术就已经包括了力学、电学、计算机、机械设计、自动控制、材料学等多个学科与技术，单独使用某个或几个相关专业英语教材均不够全面系统，缺乏与专业课程结合的紧密性、针对性。

本书针对上述问题，合理安排知识结构布局，将专业英语的教学内容覆盖新能源科学与工程专业的基础知识和新技术领域，同时，充分体现专业英语文体特征及术语，注重专业英语的功能性、交际性和任务性，注重综合应用英语能力的培养。

本书主要内容包括新能源技术基础知识、新能源发电与控制技术、新能源发电并网技术、新能源存储和运输、新能源发展前沿等方面，涉及风能、太阳能、生物质能、氢能、核能、海洋能、地热能等多种新能源技术，共分五部分，26个单元，59篇英文课文及中文科普知识短文。

本书由河北工业大学李洁担任主编，丹麦奥尔堡大学王砚帛、河北工业大学岳大为担任副主编。参编者负责的各章节课文详情如下：河北工业大学李洁编写了Part 1的Unit 1 A、B，Unit 2 A，Unit 3 A、B，Unit 4 A、B，Unit 5 A、B，Unit 7 A及Part 1的Tips A，Part 2 Unit 2 B，Unit 5 A、B，Unit 6 A、B，Part 3 Tips A、B，Part 4 Unit 1 B、Unit 2 B、Unit 3 A、B，Part 4 Tips，Part 5 Tips。丹麦奥尔堡大学王砚帛编写了Part 2 Unit 1 A、B；Part 3 Unit 2 A、B，Unit 3 A、B，Unit 4 A、B，Unit 5 A、B，Unit 6 A、B；Part 5 Unit 1 A、B，Unit 2 A。河北工业大学的岳大为编写了Part 1 Unit 2 B，Unit 6 A、B，Part 2 Unit 4 A、B，Part 4 Unit 1 A，Part 4 Unit 2 B。丹麦奥尔堡大学崔小逖编写了Part 1 Unit 7 B，Part 2 Unit 3 A、B，Part 4 Unit 4 A、B。河北工业大学的高志、苗青共同编写了Part 1 Tips B，Part 2 Tips。河北工业大学张家安编写了Part 3 Unit 1 A、B。天津职业技术师范大学的黄雷编写了Part 4 Unit 2 A，Part 5 Unit 2 B。东南大学邓富金编写了Part 2 Unit 2 A。天津凯发电气有限公司的单泽萌编写了Part 5 Unit 3 A；丹麦奥尔堡大学的胡维昊与侯鹏共同编写了Part 5 Unit 3 B。河北工业大学硕士生秦晓帆、刘晴晴、博士生李亚楠参加了本书部分的文字整理工作。

本书的编写得到了河北工业大学控制工程与科学学院杨鹏教授、刘作军教授、王华君

教授的大力支持，河北科技大学孙鹤旭教授、丹麦奥尔堡大学 Zhe Chen 教授分别为本书作序。本书得到自动化工程国家级教学团队建设基金的资助。

由于编者水平有限，本书编写的缺点和不足之处在所难免，恳请读者批评指正。

编　者

2017 年 6 月

目　录

Part 2 New Energy Power Generation and Control Technology

Part 3 Modern Power System

Part 4 New Energy Conversion and Storage

Part 5 Future Trends

Part 1

Renewable Energy Basics

本部分介绍可再生能源的基础知识，主要内容包括：能源、可再生能源及其配额制度标准等有关介绍，风能、太阳能、生物质能、地热能、核能、海洋能、氢能的利用原理和应用技术，通过本部分 7 个单元的学习，读者可以了解几类常用可再生能源的基础专业术语，并初步体会到专业英语的特点。

视 频

▶▶ 风能与风力发电

http://v.ku6.com/show/xvnbIq3E5rB1wx3YiUATtA...html

Technology Update Way to New Energy

http://v.ku6.com/show/KA0-4EKnkwvE1VqX7jtivw...html

▶▶ 中国科学技术大学：核聚变——人类理想新能源

http://tv.cntv.cn/videoset/VSET100138973616

▶▶ 你好，新能源海洋能

http://v.pptv.com/show/ltnDQakPf70gnmI.html

▶▶ 氢能—未来能源

http://v.youku.com/v_show/id_XMTQ4MDI5NDg0OA==.html?tpa=dW5pb25faWQ9MTAyMjEzXzEwMDAwMl8wMV8wMQ

▶▶ 斯坦福大学公开课：太阳能利用的基本需求

http://v.youku.com/v_show/id_XNTk5NDQ2MTky.html?from=y1.6-87.3.1.7b1d9d6e0df011e38b3f

Unit 1

A. Energy: An Overview

The word energy can have many different applications, such as when one speaks of the amount of energy (stamina) children have. In the most general sense, it relates to any usable power that is generated from certain processes. This energy power could be electricity generated from solar, wind, biofuels or water; heat generated from natural or propane gas; or fuels that power a vehicle or tractor. Energy power can be from renewable or non-renewable sources and there is much focus on finding and using renewable sources of energy. For the homemaker, energy generally relates to a source of power be it from electricity, gas, solar, wind or coal that heats or cools home, or supplies usable power to operate tools, electronics and appliances or lighting. It may also refer to water use.

In most areas, the demand for electricity increases each year but supply often does not match this demand, forcing energy prices to climb. Where electricity is considered the standard type of energy, other sources are referred to alternative energy. Alternative energy could include heating from wood-burning stoves or from propane fuel. Wind turbines or solar panels are also considered alternative methods of producing electricity.

Energy costs for a household can be as high as 20%～30% of the monthly budget, especially during periods when heating or cooling is required. Therefore, even a small effort to reduce the amount of energy use, can result in substantial savings. Buying Energy Star appliances or more energy efficient ones are ways to reduce energy use.[1]

Most of the countries currently rely heavily on coal, oil, and natural gas for its energy. Fossil fuels are non-renewable, that is, they draw on finite resources that will eventually dwindle, becoming too expensive or too environmentally damaging to retrieve. In contrast, many types of renewable energy resources-such as wind and solar energy-are constantly replenished and will never run out.

Most renewable energy comes either directly or indirectly from the sun. Sunlight, or solar energy, can be used directly for heating and lighting homes and other buildings, for generating electricity, and for hot water heating, solar cooling, and a variety of commercial and industrial uses.

The sun's heat also drives the winds, whose energy is captured with wind turbines. Then, the winds and the sun's heat cause water to evaporate. When this water vapor turns into rain or snow and flows downhill into rivers or streams, its energy can be captured using hydroelectric power.

Along with the rain and snow, sunlight causes plants to grow. The organic matter that makes up those plants is known as biomass. Biomass can be used to produce electricity,

transportation fuels, or chemicals. The use of biomass for any of these purposes is called bioenergy.

Hydrogen also can be found in many organic compounds, as well as water. It's the most abundant element on the Earth. But it doesn't occur naturally as gas. It's always combined with other elements, such as oxygen to make water. Once separated from another element, hydrogen can be burned as a fuel or converted into electricity.

Not all renewable energy resources come from the sun. Geothermal energy taps the Earth's internal heat for a variety of uses, including electric power production, and the heating and cooling of buildings. And the energy of the ocean's tides come from the gravitational pull of the moon and the sun upon the Earth.

In fact, ocean energy comes from a number of sources. In addition to tidal energy, there's the energy of the ocean's waves, which are driven by both the tides and the winds. The sun also warms the surface of the ocean more than the ocean depths, creating a temperature difference that can be used as an energy source. All these forms of ocean energy can be used to produce electricity.[2] And, considerable interest in renewable energy sources and significant increase in cost of foreign oil have compelled various countries to search for low-cost energy sources and technologies such as solar cells, wind turbines, geothermal technology, and nuclear reactors to achieve lower cost of electricity generation.[3]

Renewable energy is important because of the benefits it provides. The key benefits are following below.

Environmental Benefits. Renewable energy technologies are clean sources of energy that have a much lower environmental impact than conventional energy technologies.

Energy for Our Children's Children's Children. Renewable energy will not run out. Ever. Other sources of energy are finite and will someday be depleted.

Jobs and The Economy. Most renewable energy investments are spent on materials and workmanship to build and maintain the facilities, rather than on costly energy imports. Renewable energy investments are spent within a country, frequently in the same state, and often in the same town. This means your energy dollars stay home to create jobs and fuel local economies, rather than going overseas. Meanwhile, renewable energy technologies developed and built are being sold overseas, providing a boost to the nation trade deficit.

Energy Security. After the oil supply disruptions of the early 1970s, some countries have increased its dependence on foreign oil supplies instead of decreasing it. The increased dependence impacts more than just national energy policy.

Here, it is important to mention that a wind turbine is capable of generating greater amounts of electrical energy with zero greenhouse effects compared to other energy generating schemes including solar cell, tidal wave, biofuel, hydrogen, and biomass technologies. A wind turbine is the reverse of an electrical fan. A wind turbine uses wind energy to generate the electricity; a fan uses electricity to generate wind. In more sophisticated terminology, a wind turbine converts the kinetic energy of the wind into electrical energy.

WORDS AND TERMS

biofuel	*n.* 生物燃料
propane gas	丙烷气
tractor	*n.* 拖拉机，牵引机
wood-burning stove	木材燃烧炉
propane fuel	丙烷燃料
replenish	*vt.* 补充，再装满；把…装满；给…添加燃料
evaporate	*vi.* 蒸发，挥发；消失，失踪
water vapor	*n.* 水汽；水蒸气
hydroelectric power	水力发电；水电力
geothermal energy	地热能
tidal energy	[能源] 潮汐能

NOTES

[1] Buying Energy Star appliances or more energy efficient ones are ways to reduce energy use.

购买“节能之星”电器，或者更节能的家用电器，是减少能源使用量的方法。

[2] The sun also warms the surface of the ocean more than the ocean depths, creating a temperature difference that can be used as an energy source. All these forms of ocean energy can be used to produce electricity.

太阳加热的海洋表面的温升比海洋深处的温升高，由此产生的温差可以作为一种能源（温度差能），所有这类形式的海洋能都可以产生电能。

[3] … considerable interest in renewable energy sources and significant increase in cost of foreign oil have compelled various countries to search for low-cost energy sources and technologies such as solar cells, wind turbines, geothermal technology, and nuclear reactors to achieve lower cost of electricity generation.

…对可再生能源技术的浓厚兴趣以及外国石油成本的大幅增加，迫使各国寻求低成本的能源及其开发技术，如太阳能电池，风力发电，地热技术，以及核反应堆，以此来达到降低发电成本的目的。

B. Principles of Designing a Renewable Portfolio Standard

Introduction

Renewable portfolio standards (RPS), also referred to renewable electricity standards (RES), are policies designed to increase generation of electricity from renewable resources. Generally, these include wind, solar, geothermal, biomass, and some types of hydroelectricity, but may include other resources such as landfill gas, municipal solid waste, and

marine energy. In addition, some programs also allocate credits for various types of renewable space and water-heating, fuel cells, energy efficiency measures, and advanced fossil-fueled technologies. [1]

A renewable portfolio standard (RPS) is one of a number of policy mechanisms that might be used to help support increased development of renewable energy in China. The RPS has recently emerged as one of the leading market-based approaches to support renewable generation. [2] While specific policies differ - sometimes substantially - an RPS has been adopted in a number of US states and European nations, and is being considered by the US Congress and additional countries around the world.

The hallmark of the RPS is a market-based standard for renewable energy supply. Policymakers set the standard; typically a renewable purchase requirement applied to retail electricity suppliers or electricity generators. The market then determines the most effective, least cost way of meeting the standard. As with any policy, there are numerous ways of structuring an RPS, depending on a country's policy goals, electricity industry structure, regulatory and enforcement capabilities, social and political context. On the other hand, certain fundamental policy design principles must be adhered to if an RPS is to function with maximum impact and effectiveness.

We will discuss in the next part by highlighting RPS design principles that must be adhered to ensure an effective and low-cost RPS.

Overall RPS Principles

The RPS is generally intended to create a stable and predictable market for renewable electricity that maximizes the benefits of renewable generation while minimizing costs through the use of market mechanisms. [3] Though the RPS may be designed in many ways, as with any energy policy, certain fundamental design principles will need to be met if the RPS is to function at low cost and with maximum impact. Without these features, an RPS is unlikely to function effectively. It is therefore important to identify some of the more critical RPS design principles.

The Purchase Obligations should Drive Development of New Renewable Generation.

The primary purpose of the RPS in the long term should be to increase the share of renewable electricity serving in the grid. RPS purchase obligations should be carefully set to meet this objective. In particular, purchase requirements must be high enough to require new renewable generation development. As evidence from experience with the RPS in the United States, where this criterion is not met the RPS, is unlikely to provide substantial public benefits.

Resource Eligibility Decisions should be Made with Care

Policymakers need to determine in advance of policy implementation which renewable generating sources should be eligible to meet the RPS obligations of utilities. The RPS will be ineffectual where resource eligibility is overly broad and eligible supply exceeds RPS