# 科技英语综合教程

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副主编　贾立平　崔小清　王巧宁

AN INTEGRATED COURSE IN SCIENTIFIC ENGLISH

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# 内 容 简 介

本教材选材涵盖新能源、新材料、电子通信、自动化及控制、物联网、机械仪器、水利水电、交通安全、生命科学、环境工程十个学科领域，反映了学科最新发展动态和科研成果。共有十个单元，每个单元由 In-depth Reading、Further Reading 和 Practical Writing 三部分组成，包括简介、问题导入、课文、练习、科技翻译讲解和练习、科技写作讲解和练习等。

本教材旨在提高学生国际科学技术交流水平，可以满足不同层次的教学要求，不仅适合理工科院校英语专业本科生，也可用于理工科院校非英语专业研究生、高年级学生公共英语课程或专业英语课程教学。

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# 前　言

科技英语是为满足科学技术领域交际需要而形成的一种语言变体，用于进行科技专著、科技教材、学术论文、科学技术报告、科学考察报告、实验报告、技术标准方面的撰写和对科技情报文献进行综述等。科技英语用于对客观事物和规律进行描述、概述和论证，科学性、客观性和公正性是其内在要求，所以科技英语文体形成了自身有别于其他文体的特征。

《科技英语综合教程》的编写紧密围绕国家和区域经济社会发展需求，以国家本科专业质量标准为依据，立足科技英语文体自身特点，遵循教材教案化、教案实例化、实例多样化的编写理念，注重学生知识、能力、素养的培养，加深学生对科技英语文体的认知，增强学生对科学技术新发展、新动态的了解，使学生学有所获、学有所用、学有所能，提升学生国际科学技术交流能力。

在教材编写过程中，编者充分发挥理工科院校学科专业优势，在选材方面与相关学科专家教授进行深入交流，听取他们的意见和建议，筛选了新能源、新材料、电子通信、自动化及控制、物联网、机械仪器、水利水电、交通安全、生命科学、环境工程等学科领域素材，突出各学科领域最新研究与发展动态，凸显了选材的新颖性、科学性和前沿性。

本教材具有如下特点：

一、前沿性。本教材素材均选自国际知名学术期刊、国际学术会议论文、科技英语著作和文献，涵盖了十大学科领域，反映了各个领域的科学技术最新研究成果，选材新颖实用，语言真实地道，有助于学生获取科学技术知识，提高国际科学技术交流能力。

二、科学性。本教材以提升学生国际科学技术交流能力为导向，注重学生获取相关科技知识及掌握相关科技英语专业术语词汇、规范式表达、专业篇章架构。教材编写科学合理，既注重培养学生的一般语言应用能力，又注重提升其科技英语学术交流能力，使学生更有效地利用英语进行国际科学技术交流。

三、实用性。本教程在内容编排上以原版科技英语文献阅读为起点，精心设计形式多样的相关练习和学习任务，通过讲练结合、以练促学的方式，帮助学生系统地学习和了解科技英语的文体特征，掌握科技英语的语篇结构和表达手段，提高学生思辨能力和自主学习能力。

# Contents

# Unit 1 New Energy

## ✧ Part One: In-depth Reading

### Wind Energy in China

According to the latest official release of the national wind energy resource assessment results, 50-m-high wind energy resource potential amounts to about 2,580 GW, of which 2,380 GW is onshore and 200 GW is offshore in the 5-25-m range of water depth. The areas suitable for developing large-scale wind power include Northeast, Northwest, and North China, as well as coastal areas in the provinces of Jiangsu and Shandong, where wind power potential accounts for about 80% of the wind energy resource potential of the whole country. (This article does not contain the data and information of the Hong Kong Special Administrative Region, Macao Special Administrative Region, and Taiwan region.)

***Construction and utilization of wind power projects***

China's wind power has been experiencing rapid development since 2005. During 2005-2010, the cumulative installed capacity of wind power in China increased 35 times, adding 18.93 GW in 2010. By the end of 2010, China's cumulative installed capacity had reached 44.73 GW, surpassing that of the United States and ranking first in the world.

Large and medium-sized projects with capacities of more than 10 MW have dominated wind power plant construction in China. Especially since 2008, the government has begun to plan and construct a number of 1-GW wind power bases, and even some up to 10 GW. By the end of 2010, the number of wind power plants larger than 100 MW had reached 127, representing 64% of the existing installed capacity.

To date, China has the largest cumulative installed, grid-connected, offshore wind power capacity outside Europe. The commission of the three 3-MW offshore wind turbines at the Shanghai Donghai Daqiao offshore wind power plant in September 2009 marked the start of China's megawatt-scale offshore wind power utilization. Meanwhile, the National Development and Reform Commission (NDRC), China's top planner, launched the first round of concession projects for offshore wind power plants in May 2010, with a total capacity of 1,000 MW. By the end of 2010, the total cumulative installed capacity of offshore wind power in China had reached 142.5 MW.

In 2010, China's wind power generation was about 50.1 TW · h, which accounted for 1.28% of the net electricity consumption. The wind power generation with in the northeast power grid reached 17 TW · h, or 6.0% of the net electricity consumption; the wind power generation within the eastern region of the Inner Mongolia power grid reached 5.9 TW · h, or 21.1% of the net electricity consumption. In 2010, the average full load hours of wind turbines amounted to 2,082.

***Related policies and regulatory framework***

The Renewable Energy Law of the People's Republic of China (PRC) was adopted at the 14th session of the Standing Committee of the Tenth National People's Congress on 28 February 2005 and took effect on 1 January 2006. The law established the basic legal system for China's renewable energy (RE) development and formed a general policy and regulatory framework for promoting renewable energy development and utilization. On the basis of the law, the National Energy Administration (NEA), Ministry of Finance (MOF), State Electricity Regulatory Commission (SERC), and the other related government authorities successively issued a series of specified policies and regulations on RE generation, covering the definitions and related regulatory measures with respect to priority scheduling and priority purchasing as well as cost sharing among electricity consumers nationwide.

Through efforts spanning several years, a series of policies and a regulatory framework to promote RE development have been put in place in China. In order to keep up with the rapid development of RE, the Amendment of the Renewable Energy Law was adopted at the 12th session of the Standing Committee of the 11th National People's Congress on 26 December 2009. The amendment emphasized the responsibilities and obligations of central and local governments regarding the surveying of resources and development planning and provided detailed support for the integration of RE generators. The amendment established a dedicated RE development fund, whose sources include both financing from the central government budget and revenue from a legally authorized levy on electricity consumers nationwide (the "RE electricity surcharge"). To date, some of the methods supporting the Renewable Energy Law are still under development or revision.

***Outlook for China's wind power development***

Wind power will continue its rapid development in the coming decades, due to China's commitment to energy efficiency and carbon dioxide emission reduction. During the 2010 United Nations Climate Change Conference held in Copenhagen, the Chinese government promised to devote major resources to developing renewable and nuclear energy to ensure that by 2020, consumption of non-fossil fuel power will account for 15% of the country's total primary energy consumption and the intensity of carbon dioxide emissions per unit of

GDP will be reduced by 40%-45% as compared with the emission level of 2005. The Chinese government accordingly has decided to dedicate a supplementary investment of CNY500 billion to developing RE and nuclear power over the next ten years. It appears that RE may assume even greater significance than previously thought as a consequence of the nuclear disaster at the Fukushima Daiichi power plant in Japan.

Preliminary analysis indicates that the contribution rate of wind power to the 15% goal is about 10%, which means wind power capacity must reach at least 150 GW by 2020. This in turn means that in the years 2010-2020, the growth rate of wind power installed capacity will be kept at least at 14%, or 12 GW of annually added capacity. According to China's 12th Five-Year Plan, the generation of non-fossil fuel power will account for 11.4% of the country's total primary energy consumption by 2015, instead of 8.2% as in 2005. By 2015, there will be about 100 GW of wind power, which could displace the equivalent of 430 million tons of coal and reduce $CO_2$ emissions by 1.2 billion tons annually, contributing 5% to achieving the emission reduction goal.

We believe that the experience and success of China in large-scale wind power development will be a valuable contribution to the development of global wind power utilization. With the gradual construction of large-scale wind power bases and the continued technical progress of domestic wind turbine technology, China's manufacturing enterprises will maintain the growth of quantity as well as quality. Apart from supplying the domestic market, these companies will provide excellent equipment and service to the global market. At the same time, the experience of solving the large number of technology and management challenges faced by China, including the lack of system flexibility, long-distance transmission, and large-scale wind power development, will establish a good base of operating knowledge that can provide useful insights for other countries and regions in the world.

Adapted from *IEEE Power & Energy Magazine*, 2011

## ☞Notes to the text

1. MW、GW：分别是英文 megawatt（兆瓦）和 gigawatt（十亿瓦）的缩写，是表示功率的单位，常用来指发电机组在额定情况下单位时间内能发出来的电量。1GW=1000MW。
2. TW · h：太瓦 · 时，1TW · h=1 亿千瓦 · 时。
3. The National Development and Reform Commission (NDRC)：中华人民共和国国家发展和改革委员会。
4. The Standing Committee of the Tenth National People's Congress：第十届全国人民代表

大会常务委员会。

5. State Electricity Regulatory Commission (SERC)：（中国）国家电力监管委员会。
6. CNY：人民币代码，是 ISO 分配给中国的币种表示符号。在国际贸易中是表示人民币"元"的唯一规范符号，现在已取代了 RMB￥的记法。

## ☞New words and expressions

| | | | |
|---|---|---|---|
| **amend** | [ə'mend] | *vt.* | to change a law, document, statement, etc slightly in order to correct a mistake or to improve it 修正，修订（法律、文件、声明等） |
| **capacity** | [kə'pæsəti] | *n.* | the number of things or people that a container or space can hold 容量；容积；容纳能力 |
| **cumulative** | ['kju:mjələtɪv] | *adj.* | having a result that increases in strength or importance each time more of sth is added （在力量或重要性方面）聚集的，积累的，渐增的 |
| **dioxide** | [daɪ'ɒksaɪd] | *n.* | a substance formed by combining two atoms of oxygen and one atom of another chemical element 二氧化物 |
| **disaster** | [dɪ'zɑ:stə] | *n.* | an unexpected event, such as a very bad accident, a flood or a fire, that kills a lot of people or causes a lot of damage 灾难；灾祸；灾害 |
| **emission** | [ɪ'mɪʃn] | *n.* | the production or sending out of light, heat, gas, etc （光、热、气等的）发出，射出，排放 |
| **enterprise** | ['entəpraɪz] | *n.* | a company or business 公司；企业 |
| **equivalent** | [ɪ'kwɪvələnt] | *adj.* | equal in value, amount, meaning, importance, etc （价值、数量、意义、重要性等）相等的，相同的 |
| **fossil** | ['fɒsl] | *n.* | the remains of an animal or a plant which have become hard and turned into rock 化石 |
| **levy** | ['levi] | *vt.* | to use official authority to demand and collect a payment, tax, etc 征收；征（税） |
| **preliminary** | [prɪ'lɪmɪnəri] | *adj.* | happening before a more important action or event 预备性的；初步的；开始的 |
| **priority** | [praɪ'ɒrəti] | *n.* | something that you think is more important than other things and should be dealt with first 优先事项；最重要的事；首要事情 |

| | | | |
|---|---|---|---|
| **renewable** | [rɪˈnjuːəbl] | *adj.* | capable of being replaced by natural ecological cycles or sound management practices 可更新的；可再生的 |
| **span** | [spæn] | *vt.* | to stretch right across sth, from one side to the other 横跨；跨越 |
| **successive** | [səkˈsesɪv] | *adj.* | following immediately one after the other 连续的；接连的；相继的 |
| **supplementary** | [ˌsʌplɪˈmentri] | *adj.* | provided in addition to sth else in order to improve or complete it 增补性的；补充性的；额外的；外加的 |
| **surcharge** | [ˈsɜːtʃɑːdʒ] | *n.* | an extra amount of money that you must pay in addition to the usual price 额外费用；附加费；增收费 |
| **utilize** | [ˈjuːtəlaɪz] | *vt.* | to use sth, especially for a practical purpose 使用；利用；运用；应用 |

## ☞Exercises

### Ⅰ. Vocabulary

**Fill in the blanks with the words or phrases listed below in their appropriate forms.**

| | | | | | |
|---|---|---|---|---|---|
| supplementary | utilize | renewable | priority | successive | levy |
| equivalent | amend | span | capacity | emission | dioxide |

(1) It will be found of _________ by its users.

(2) He _________ his regular meals by eating between meals.

(3) There was a dispute about the rightful _________ to the throne.

(4) His life _________ almost the whole of the 19th century.

(5) When hot weather comes, there will be a _________ of interest in swimming.

(6) The badly wounded take _________ for medical attention over those only slightly hurt.

(7) The government _________ taxes for national expenses.

(8) Some American words have no British _________.

(9) Your plan needs some _________ before it can be made public.

(10) Japan's _________ for progress is hampered by its lack of resources.

## Ⅱ. Cloze

**Choose an appropriate word from the following list to fill in the blanks. Each word can only be used once. Change the form if necessary.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| respect | financial | demonstration | leading | secondment | activity | benefit | deliver |
| highlight | relationship | exemplify | sustain | exchange | information | co-operation | |

From 25 February to 1 March, NEA [Nuclear Energy Agency, (经济合作与发展组织)核能署] Director-General Magwood led a high-level visit to China. Bilateral meetings were held with the National Nuclear Safety Administration (NNSA), the China Atomic Energy Authority (CAEA), the National Energy Administration (C/NEA) and the China National Nuclear Corporation (CNNC). Technical visits were made to the Qinshan Nuclear Power Plant and the Fuqing Nuclear Power Plant, where China is building the first Hualong One nuclear power reactor. During the meeting with the CAEA, both parties agreed upon the importance of multinational ___1___ in nuclear skills and education in order to ensure the safe, secure and ___2___ use of nuclear energy. In this ___3___, China highlighted the Atomic Energy Scholarship of China (AES), which has been initiated by the CAEA and the Ministry of Education of China in order to provide ___4___ support to outstanding students, technicians and administrators from emerging nuclear energy countries. Details and further information on the scholarship are available here.

The NEA delegation also visited some of the country's ___5___ research centers, including the Shanghai Institute of Applied Physics (SINAP) which is leading China's development and ___6___ of molten salt reactor technology, the Shanghai Nuclear Engineering Research and Design Institute (SNERDI) and the Chinese Academy of Sciences (CAS). On 28 February, Director-General Magwood ___7___ a lecture on NEA work and activities to nuclear science and engineering students at Shanghai Jiaotong University (SJTU). The visit, which was very ___8___ and constructive, exemplified the valuable exchange of information and ideas from which China and the NEA can both ___9___. Highlighting the growing relationship between the NEA and China, the Agency welcomed in March 2018 a Chinese radioactive waste expert on ___10___ to work at the NEA in Paris for the next two years. She will be the first Chinese expert to join the NEA's main secretariat staff.

## Ⅲ. Translation

**1. Translate the following into Chinese.**

On 20 March 2018, the NEA visited The National Nuclear Energy Commission of

Brazil to participate in an information exchange seminar attended by representatives from the important fields in Brazil's nuclear power programme. NEA Deputy Director-General and Chief Nuclear Officer Dr Daniel presented the Agency's activities, its role among international organisations and its work on nuclear technology, safety and radioactive waste management. Discussions addressed a wide range of associated issues, including stakeholder involvement. During the seminar, NEA representatives were also introduced to the main lines of nuclear energy policy, research and education in Brazil. While in Brazil, the NEA delegation also visited the Angra Nuclear Power Plant and other institutions in order to gain insights into nuclear technology in Brazil. The seminar and the visit were both very informative and constructive, and took place in a spirit of openness, and mutual recognition of the benefits of international co-operation. The NEA wishes to thank the Brazilian Ministry of Foreign Affairs for the well-prepared seminar and fruitful exchanges during the visit.

**2. Translate the following into English.**

(1) 在不断持续的能源紧张中，不少人想到了新能源利用。
(2) 风能是太阳能的一种转换形式，是一种重要的自然能源。
(3) 洁净能源指太阳能、风能、潮汐能、生物能等，这都是可再生的能源。
(4) 随着化石能源的不断消耗和人们对全球环境状况的日益关注，风能的开发利用引起了世界各国的重视。
(5) 这些因素严重阻碍了中国风电的可持续发展，必须采取相应措施加以解决。
(6) 本文说明了陆地风能评估标准不能完全适用于近海风能评估。
(7) 我们应该加快近海风能资源评估体系建设，做好近海风能资源变化趋势预测。
(8) 本文为建立更合理的风能资源评估模型提供了参考依据。
(9) 风力作为可再生能源，它对环境的保护和能源结构的调整有着十分重要的意义。
(10) 可持续发展是全球的共同目标。风能作为一种清洁的可再生能源，必将成为 21 世纪最重要的能源之一。

# ✧ Part Two: Further Reading

### Mixed Mode Operation for the Solar Aided Power Generation

Solar thermal power generation has the advantages of clean, low greenhouse emissions. However, solar thermal power also suffers from high costs and the variable nature of the resources. Since fossil-fired power plants are still the backbone of electricity production and have the advantage of lower costs but the disadvantage of high greenhouse emissions, therefore integrating solar energy into fossil-fired power plants is attracting growing attention. Solar Aided Power Generation (SAPG) is one of the integrating technologies in which the solar thermal energy is used to displace the heat of extraction steam (in Regenerative Rankine Cycle, RRC) to preheat the feed water to the boiler. The displaced extraction steam can therefore expand further in a steam turbine to generate power. Compared with a stand-alone solar power plant, the solar to power efficiency of an SAPG plant is not capped by the solar collector's temperature. It was also found that this technology has the advantage of a lower capital cost than other integrating technologies. Compared with a stand-alone power plant, the SAPG plant still has a higher thermo-economic benefit.

An SAPG plant can be operated in two modes of operation: a power boosting (PB) mode and a fuel saving (FS) mode. The PB mode is defined as using the displaced extraction steam to generate additional power without changing the steam flow rates of the boiler. The FS mode is defined as to maintain the power output of the plant by reducing the fuel consumption of the boiler. When the SAPG plant is operated in FS mode, the steam flow rates of the boiler should be adjusted i.e. reduced. The benefit of the PB mode of operation is the increased power output, which has great potential when coupled with a high on-grid electricity tariff. The benefit of the FS mode of operation is the decreased fuel consumption, which has great potential for making savings in the face of rising fuel prices and the carbon tax. It was found that with the same solar thermal input, the displacement of extraction steam at a higher temperature leads to higher technical benefits, i.e. to additional power output for the PB mode of operation and saved fuel consumption for the FS mode of operation.

When assessing the economic performance of an SAPG plant, most of the previous studies used the levelized cost of electricity (LCOE) as the economic criterion. It was found that, based on the PB mode of operation, there is a 5%-7% increment in the LCOE for an SAPG plant over a stand-alone power plant. It was also found that the carbon tax still has an impact on the LCOE of an SAPG plant operated in PB mode. The LCOE of an SAPG plant operated in FS mode is higher than that operation in PB mode. However, based on an SAPG plant operated in PB mode, Pierce et al. found that an SAPG plant is more cost effective than a stand-alone power plant due to the lower capital costs. Based on an SAPG plant operated in FS mode, Hou et al. found that there is an optimal solar field area for an SAPG plant to achieve the lowest LCOE. Wu et al. and Zhou et al. also found that the optimal solar field area was influenced by the solar radiation, storage capacity and load of the power plant. For an SAPG operated in FS mode, it was found that adjusting the solar thermal temperature and storage capacity can also help to achieve lowest LCOE for an SAPG plant. From previous studies, it was found that the measurements of SAPG plants always assume either PB or FS modes of operation for a whole year. Such an evaluation of LCOE and capital cost for the SAPG plant can help to optimize the design of the SAPG plant but cannot guide its operation.

As the SAPG plant is operated under variable electricity on-grid tariffs and fuel prices, an SAPG plant operated in PB or FS modes of operation for a whole year would achieve a different annual performance. Once an SAPG plant has been built, mixing the PB and FS modes may achieve greater annual economic returns for the SAPG plant. However, as the previous studies are based on a single mode of operation, there is a gap in the knowledge as to how to switch between PB and FS modes to achieve greater annual economic returns. Also, in order to compare the economic profitability of an SAPG plant operated in both PB and FS mode, a new economic related criterion that links the electricity on-grid tariff and the fuel price together in order to evaluate the potential profitability of an SAPG plant, which can then be used to guide the actual operation of an SAPG plant, is required.

In the present paper, how to operate the SAPG plant to achieve maximum economic returns under different market conditions has been explored. A mixed mode of operation and a Relative Profitability (RP) criterion are proposed for guiding the operation of the SAPG plant to achieve the maximum economic benefit for the plant owner/operator. In particular, the economic returns of a mixed mode of operation and a single mode operation have been compared.

An SAPG plant can be operated in either power boosting (PB) or fuel saving (FS) mode. Previous studies on an SAPG plant all assumed that the plant was operated in a single mode of operation for long periods of time; at least a season or a year. In order to optimize the operation of the plant and its economic benefits, the concept of mixed modes of operation is proposed. The mixed operation is such that the hourly operation mode (PB or FS) is determined by the hourly Relative Profitability (RP) calculated values. In the hourly RP calculation, the local electricity and fuel market conditions are taken into consideration to estimate/calculate the plant's hourly profitability in both PB and FS modes in order to determine the mode the plant should be operated in during that hour. The advantages of the mixed mode of operation are demonstrated through two case studies in this paper. The electricity on-grid tariff in Beijing and Adelaide and the monthly fuel price in the international market were used for the case studies. The results draw the following conclusions:

- The mixed mode of operation is always superior economically over, or equal to, a single PB or FS mode of operation in the given electricity and fuel markets, especially in an electricity market that fluctuates significantly (i.e. in Adelaide, Australia). In Adelaide, the ARP of the mixed mode of operation is up to 12.1% and 11.4% higher than the PB and FS modes, respectively. In Beijing, the ARP of the mixed mode of operation is up to 1.3% and 2.0% higher than the PB and FS modes, respectively. Also, it was found that the mixed mode of operation has more advantages than the PB and FS modes when the fuel price is relatively high.

- With the increase in the electricity on-grid tariff, the benefit of the mixed mode of operation over the PB mode is decreased. On the contrary, with an increase in fuel prices, the benefit of a mixed mode over an FS mode is decreased.
- With the increase of the other (operational) costs of the SAPG plant (including O & M, bank interest charges etc), the benefit of the mixed mode of operation over the single mode of operation remains unchanged.

The present study used the historic data from China and Australia to demonstrate the merit of the mixed operation over single mode operation. If an electricity market model that would predict the price and the demand of electricity could be developed and integrated with the mixed mode operation concept, the real economic benefits would be delivered to the SAPG plant operator/owner.

Adapted from www.elsevier.com/locate/apthermeng, 2018

## ☞Notes to the text

1. SAPG (Solar Aided Power Generation)：太阳能辅助发电，是在常规燃煤发电机组基础上，合理集成太阳能光热系统组成的集热式太阳能复合热发电，是实现太阳能大规模利用和燃煤机组深层次节能的有效途径和技术方向。
2. RRC (Regenerative Rankine Cycle)：再生朗肯循环是指以水蒸气作为制冷剂的一种实际的循环过程，主要包括等熵压缩、等压冷凝、等熵膨胀和一个等压吸热过程。可以用来制热，也可以用来制冷。
3. LCOE (levelized cost of electricity)：发电站的均化发电成本。

## ☞Exercises

### Ⅰ. Reading Comprehension

**Answer the following questions according to the text.**

(1) What is the advantage of Solar Aided Power Generation?

(2) How can an SAPG plant be operated?

(3) What economic criterion is used in most of the previous studies when assessing the economic performance of an SAPG plant?

(4) How can we achieve greater annual economic returns for the SAPG plant once an SAPG plant has been built?

(5) What concept is proposed in the paper to optimize the operation of the plant and its