唐必光　谢诞梅　主编

火电厂专业英语

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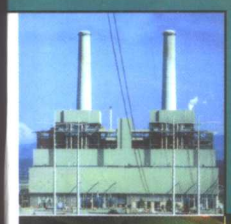
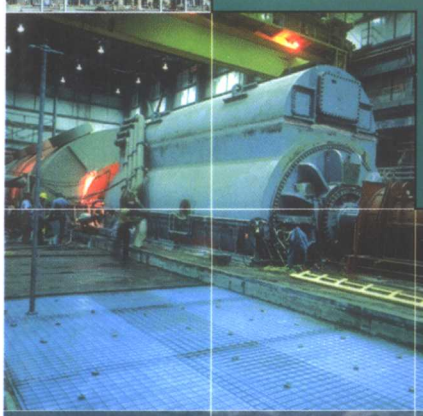
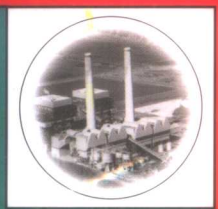
系列专业英语

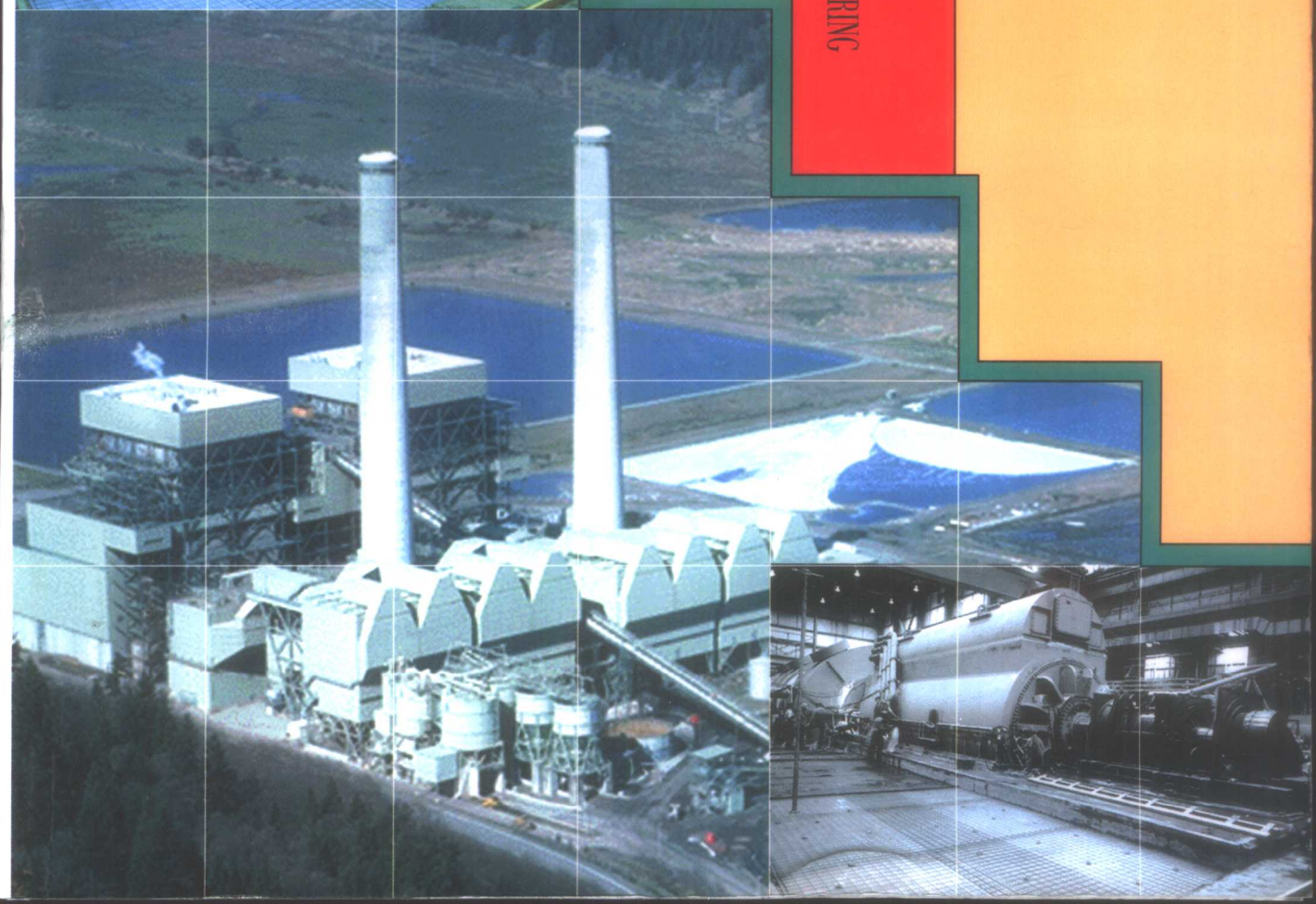
ENGLISH

FOR THERMAL POWER ENGINEERING









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English for Thermal Power Engineering

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序

随着我国改革开放的深入和经济的发展，我国电力工业迅速发展，尤其是火电厂建设迈上了一个新台阶，引进机组和设备不断增加，对外交流日益频繁。广大火电厂建设、管理和运行的科技人员和工作人员以及相关专业的在校大、中专学生，迫切需要掌握英语这一对外交往的工具，学习先进技术，促进对外交流。

作为一所全国重点大学，武汉水利电力大学每年向国家输送大量电力建设专业人才。由于国家经济体制的进一步改革，电力工业无论在深度和广度上都发生了深刻的变化。因此，对人才素质的要求越来越高。为了适应这一变化，武汉水利电力大学以“211 工程”为契机，深入教育改革，发展学科建设，充实、更新教学内容，推出了一批深受学生和社会好评的教材和教科书。

唐必光和谢诞梅等同志所编的这本《火电厂专业英语》教材，是他们在武汉水利电力大学任教期间，瞄准向火电厂培养“全能值班员”这一目标，根据学生、尤其是广大现场工作人员的实际要求，并结合自己的教学经验编写而成的。全书以锅炉、汽轮机和发电机三大主机为主线，广泛涉及大型机组(600 MW 和 300 MW)的结构、原理、运行和管理等内容，还包括火电厂的设计规划及厂址选择、自动控制、电厂化学及环境和招标等内容。特别值得一提的是，这本书还涉及诸如洁净煤技术、DEH 控制系统、燃气-蒸汽联合循环技术、烟气脱硫技术、计算机控制等许多高新技术。全书内容新颖，专业词汇覆盖面广，生词重复率高。全书的内容编排不仅保持了火电厂专业知识的系统性，而且符合英语教学的特点。

因此，我很高兴地向广大读者推荐这本教材。希望并相信它对与火电厂有关的在校本专科学生、研究生和工程技术人员学习英语、并掌握当今技术发展能有所裨益。

刘吉臻

1999.6.5.

前　言

能源基础建设是我国经济建设的基础。随着我国改革开放的深入和经济的发展，我国火电厂的建设迈上了一个新台阶，对外交流日益频繁，引进机组不断增加。为了帮助火电厂建设、管理和运行的广大科技人员和工作人员，以及相关专业的在校大、中专学生，利用英语这一语言工具，掌握先进的技术，我们编写了这本《火电厂专业英语》。

全书共分七部分，55 个单元，总阅读量为 280 000 词左右。内容以锅炉、汽轮机和发电机三大主机为主体，广泛涉及大型机组（300MW 和 600MW）的设备、材料、运行和管理等方面，瞄准向火电厂培养“全能值班员”这一目标，在本教材中还设置了火电厂的设计规划和厂址选择、自动控制、电厂化学和环境等内容，尤其是许多诸如洁净煤技术、DEH 控制系统、燃气-蒸汽联合循环技术、烟气脱硫技术、计算机控制等高新技术，对工程技术人员掌握当今技术极有帮助。此外，考虑到目前大多数火电厂项目采用国际竞争招标，本教材特别设置了有关招标的内容。所有英文选自近年出版的英文原版书刊和文献，内容丰富，新颖。全书共涉及 1 175 个生词及专业词汇，专业词汇覆盖面宽。全书的内容排列不仅保持了火电厂专业知识的系统性，而且符合英语教学的特点。为便于读者使用，每单元附有词汇表，全书后附有总词汇表，并配有参考译文。

全书由唐必光、谢诞梅担任主编。参加编写的人员有：向军（第一部分）、唐必光（第二部分）、谢诞梅（第三部分和第七部分）、李培生、史慧萍（第四部分）、袁立宏（第五部分）、于萍（第六部分）。谢诞梅、刘军平审定和校阅了全部书稿。

在编写过程中，得到武汉水利电力大学动力机械学院、教材科、出版社、黄冈电厂筹备处等单位各级领导和同仁的大力支持。在此，一并表示衷心的感谢。

由于我们水平有限，书中错误在所难免，欢迎广大读者批评指正。

编者

1999 年 6 月于武昌

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参考译文目录

Part One Power Plant Designing and Planning

Unit One

Electric Power Industry in China

Present Situation

The year 1995 is the last year of the 8th Five-year Plan period in China. During the period, a remarkable result has been achieved in energy industry and electric power industry as its kernel. In 1995, the total primary energy production got to 1.287 billion tons of standard coal with an increase of 23.8% compared with 1990, which includes 1.361 billion tons of raw coal, 150 million tons of crude oil, 17.95 billion cubic meters of natural gas.

In order to cope with the increasing demands of industry, agriculture and other sectors, the nation's total annual electricity generation has been going up rapidly and amounted to 1 007.7 TW·h in 1995, representing a rise of 62.2% over 1990. The total thermal, hydro and nuclear power generation accounted for 804.3TW·h, 190.6TW·h and 12.8TW·h in the year, representing 79.8%, 18.9% and 1.3% respectively. In the aspect of capital construction, total of 79.33 GW of generating capacity was installed in the last five years, which averages an annual add-ups by 16 GW and makes the nation's total installed capacity reach 217.22 GW by the end of 1995, in which thermal, hydro and nuclear power shared 75.0%, 24.0% and 1.0%.

Along with the rapid growth of installed generating capacity, the construction of high

voltage transmition lines and expansion of power networks have been speeding up in recent years. By the end of 1995, the total length of 35 kV and above level lines amounted to 566 707 km, of which 500 kV, 330 kV and 220 kV lines accounted for 13 052 km, 5 609 km and 96 913 km respectively.

In 1995, the national net coal consumption rate of thermal power plants witnessed a new record 412 g/kW·h, reduced by 16 g/kW·h, as compared with 428 g/kW·h in 1990.

As a result of the progressive development of the electric power industry, electricity has become more and more significant for the progress of the national economy and the improvement of the living standards. The total electricity consumption of 1995 amounted to 988.64 TW·h with an increase 61.38% over 1990. The electricity consumption has stepped up in various sectors as follows: the industrial sector consumption has an increase 51.95% during last five years; agriculture consumption, 43.63%; transportation and telecommunication, 68.08%; municipal and commercial sector, 98.54%; residential consumption, 109.73%, representing the highest growth rate than those of other sectors.

Outlook and Strategy

According to the situation of energy resources and its development strategy, the policy for power industry can be outlined as follows:

1. Developing thermal power vigorously to give full play to the superiority of rich coal resources.

The thermal power based on coal-fired will still be the main power for meeting the electricity demand and the share of the thermal power in the total electric generation will keep 75% ~ 77% during 1990s. By the end of the century, the total thermal installed capacity will go up to 160 GW, representing the share of thermal power in total installed capacity being 67% (63% ~ 63.5% for coal-fired and 3.5% ~ 4% for oil and gas-fired).

In order to speed up development of thermal power and improve the generation efficiency, stress should be focused on construction of large power plants with large sized high temperature and high pressure efficient units, e.g. sub-and super-critical parameters units of 300 MW and 600 MW are mainly the options. It is the prior consideration to build a number of large and backbone thermal power plants in pit-head of huge coal mines.

2. Speeding up hydropower on some river sections with favorable conditions.

At present, however, the hydropower installed capacity is only less than 10% of

exploitable potential. This situation means that efforts should be concentrated on continuous exploitation of some river. The key points for hydropower exploitation in the coming years should be to develop the water resources of the upper and middle reaches of Changjiang River, upper reaches of Huanghe River as well as Hongshui River basin for speeding up hydropower expansion.

3. Expanding power networks to bring the benefits of interconnecting networks into full play

In the coming ten years, the following key projects have been tentatively arranged:

——The 500 kV transmission lines from the coal electricity base in eastern Inner Mongolia to Northeast China.

——The 500 kV transmission line from Shanxi, Shanxi and western Inner Mongolia to the Beijing—Tianjin—Tangshan area.

——The 500 kV transmission line from the Southwest China to Guangdong province.

In addition, long distance and high voltage transmission lines will be constructed from Shanxi and Henan provinces to Jiangsu and Hubei provinces, so as to realize "sending electricity from the West to the East as well as from the North to South".

4. Mastering manufacture and construction technology of nuclear power as soon as possible to create conditions for speeding up its development after the year 2000.

Due to shortage of coal deposit and hydropower in the Southeast coastal region and Northeast China, it is in urgent need to build nuclear power plants, as a supplement to thermal and hydropower, to meet the continuously increasing load-demand and to gain experience in further developing nuclear power. At present, Qinshan Nuclear Power Plant with 300 MW of capacity and Daya Bay Nuclear Power Plant with 2 × 900 MW PWR units have been put into operation. It is planned to construct some other nuclear plants, such as Qinshan 2 × 600 MW PWR units and Liaoning 2 × 100 MW nuclear plant, and the total nuclear power installed capacity will be 6 000 ~ 7 000 MW by the year 2000, taking share 2.5% ~ 3% in the nation's total.

5. Opening new energy resources to pay great attention to rural electrification.

While making efforts to develop conventional energy resources, opening new energy resources for power generation has been encouraged. Several kinds of resources, such as small hydro, wind, tidal, solar and geothermal power, have been developed in accordance with local energy resources conditions.

New Words and Expressions

the 8th Five-year Plan	第八个五年计划
kernel	核心
primary energy	一次能源
standard coal	标准煤
raw coal	原煤
crude oil	原油
cubic meter	立方米
hydro power	水电
installed/generating capacity	装机/发电容量
thermal power	火电
high voltage	高压
coal consumption rate	煤耗率
transmission line	输电线
municipal	市政的
energy resource	能源
vigorously	大力地
coal/oil/gas fired	燃煤/油/气
electricity demand	电力需求
generation efficiency	发电效率
sub-and super-critical parameters units	亚临界和超临界参数机组
backbone	主干,中坚
pit-head	煤矿坑入口,坑口
coal mine	煤矿
exploitation	开发
interconnecting networks	联网
nuclear power plant	核电站
deposit	矿床,矿层
PWR(Pressurized Water Reactor)	压水堆
put into operation	投入运行
tidal power	潮汐发电
solar power	太阳能发电
geothermal power	地热发电

Unit Two

Plant Designing

System Planning

The CEGB has to evaluate the need for power stations in the light of its statutory duties. It considers whether there is a need for new capacity in order to maintain an adequate security of supply, or to give greater economy or to improve the security of fuel supply by allowing the types and sources of fuel or primary energy to be diversified. In addition it may be justifiable to build a new form of generating capacity in order to prepare the ground for a possible future benefit.

Capacity Considerations

Capacity requirement is determined by the need to meet the peak demand of the year. The first step in estimating generating capacity requirement is therefore to forecast the peak demand for each future winter up to the planning years. The forecast presumes that the peak is most likely to occur on working weekdays in December to February during a spell of cold weather of average severity and is thus described as the 'average cold spell' (ACS) winter peak demand. ACS conditions are determined by a statistical analysis of past weather data and the variation in demand caused by weather variations.

In order to meet the statutory requirement to provide a continuous supply of electricity except in cases of emergency, the industry has over many years aimed at providing sufficient generating capacity to meet the future demand with a high degree of security. It is the CEGB 's function to ensure that sufficient generating capacity is provided to meet the peak demand and it achieves this by making a plan.

Economic Considerations

The provision of new capacity to meet the forecast demand is not the only reason which might justify the construction of new generating plant. New construction might also be justified on economic grounds and might allow the retirement of some existing capacity. In principle, a plant is retained in service until it becomes more economic to replace it with new capacity. Evaluations are made for certain economic indicators for existing

stations and for the potential new stations that might be built:

(1) For existing stations, the annual avoidable cost is evaluated, on a year-by-year basis, of retaining certain stations or parts of stations in an operable condition. This cost is called the 'net avoidable cost' (NAC) expressed in units of £/kW pa.

(2) For new generating station options for commissioning by the planning years, the CEGB calculates the net effect on total system costs of building and operating the station over its lifetime and converts this into an average annual cost, in units of £/kW pa, called the 'net effective cost' (NEC).

These indicators allow two economic comparisons to be made. Firstly, the comparison of NEC for alternative new generating plant options allows, for given assumptions of input parameter values, the identification of the most economic option, namely the one with the lowest NEC. Secondly, for that option, it is possible to test whether it is economic to install the new plant and commission existing capacity.

Selection of Alternative Generating Plants

When added to the existing electricity supply system to meet increasing capacity needs, the power station would show a benefit by reducing overall system cost. The method of analysis adopted is to establish, from previous experience or by preliminary design studies, the capital cost, fuel costs, manpower and other operating costs, for each alternative type of plant. The annual costs of owning and operating the plant are then:

(1) Annual charges on capital, including repayment of the capital and interest. This charge may include the costs of raising finance during the construction phase, any government taxes related to capital, and allowances for the cost of commissioning and dismantling the station.

(2) Annual costs of fuel for the expected hours of use, including any costs associated with disposal of waste (ash, nuclear waste).

(3) Annual costs of maintenance, manpower, etc.

The nuclear plant, having low fuel and operating costs was predicted to have a high load factor throughout its lifetime, and these low operating costs offset the high capital charges. The implications on plant design are that the nuclear units will run, as far as they are able, at virtually constant full load output.

The coal-fired unit having a higher fuel and operating cost, was predicted to have a high load factor in the early years of its life, but to operate intermittently for increasing periods in its later years. The uncertainty in predicting load patterns many years in advance results in the need to specify for these plants a combination of operating regimes,

which is onerous in terms of load-cycling capability, including the ability to respond reliably to demands for rapid loading and deloading.

At the time when the oil-fired units were selected, the lifetime cost of oil was expected to be lower than that of coal, and the plants were specified to have high initial load factors, but to operate intermittently later in the lifetime. However, the abrupt rise in oil cost has meant that oil-fired units have been allocated a low lifetime load factor since they were commissioned, and they have been generally called upon to operate in a peaking role.

The pumped storage plant can be regarded in system operational terms as complementing both the nuclear and the coal-fired plant. When surplus nuclear and coal-fired capacity becomes available at night-time, the storage of water for regeneration of electricity during the daytime is itself economic. In addition, the very rapid loading which has been possible is of considerable value in relieving some of the coal-fired plant of the need to respond to rapid changes in system demand, with a resulting saving in system operating cost.

New Words and Expressions

CEGB (Central Electricity Generating Board)	中心电力委员会
in the light of	根据
statutory	法定的,依照法规的
peak demand	尖峰负荷需求
severity	严寒
variation	差异
provision	供应
retirement	退役
retain	保持,保有
annual	一年一次的
avoidable	可避免的
pa = per annum	每年
convert	使(一种形式)转变成(另一种形式)
commission	委托,代办,交付运行
preliminary design	初步设计
capital	资本,资金
manpower cost	人力费
raise finance	筹措资金
phase	阶段,时期
allowance	特别经费