新编 电力英语教程

下卷

A New Course of English for Electric Power

Vol.3

上海电力学院外语系组编

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前　言

改革开放以来，在我国的工业门类中，电力工业发展最为迅速。各大电网已覆盖全国城市和大部分农村，我国的发电装机容量和发电量均居世界第二位。我国电力工业已进入以大机组、大电厂、大电网、超高压、自动化为主干的新时期。

然而，随着我国经济的不断发展和人民生活水平的提高，尤其是中国加入 WTO 后，国内电力供应日趋紧张。现有的发电装机容量和发电量已不能适应现代化建设的需要，急需登上一个新的台阶。而电力工业的崛起将依赖于一大批素质高，业务强，懂英语的电力科技人才。

那么电力行业对技术人才的英语水平有何种要求？显然英语 4 级、6 级证书并不能说明持证者应用英语的实际水平。我们认为懂英语就是要能用英语进行听说读写译全方位的活动。懂英语就是要能在商务谈判、学术交流中与外国同行用英语进行自由的交谈，探讨电厂建设、电力生产、传输、销售等各个方面的问题。懂英语就是能用规范的英语撰写论文、报告、信函。显然目前的培养模式和英语教材已无法适应新型的电力科技人才的培养。为此我们必须开始新一轮的教改。我们的目的是彻底改变电力学院毕业生的外语素质，使他们在未来能充分利用自己在外语方面的优势，在电力人才市场占有一席之地。

具有 60 年校史的上海电力学院是培养电力科技工作者和电力系统急需人才的摇篮。为培养造就更多的能与国际电力水平接轨的复合型人才，我们组织了英语专家学者，精心编写了一套覆盖听说读写译 5 个方面、涵盖电力行业方方面面的新编电力英语教程。

丛书特色：“新编电力英语教程”深入浅出、内容丰富、涉猎广泛、题材多样。融科学性、趣味性和实用性为一体，以新、大、全为特色。突出了基本功的培养。丛书共分 3 卷，每卷由 3 个分册组成，各册内容分别为：

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(第 7 册)电力科技英语；(第 8 册)电力市场英语；(第 9 册)电力英语翻译

读者对象：“新编电力英语教程”的阅读对象为电力院校的大学生以及从事电力工作的英语爱好者。广大读者通过阅读学习本丛书可以开阔视野，获取信息，增长知识。“新编电力英语教程”是广大学生和电力英语爱好者的良师益友。

参编人员：本丛书由上海电力学院外语系组编，参加本丛书的编写人员是一个具有丰富教学经验、较强科研能力的群体，包括教授 3 名、副教授 8 名、博士 1 名，讲师 12 名，英美留学人员 6 名。部分教师在全国电力系统及上海市享有一定的知名度和影响，教学、科研成果丰硕。

本书的总主编杨大亮，各分册主编、副主编的名字分别在各分册中，唐俭和吴远恒是

上卷的主审，魏永红和庄起敏是中卷的主审，庄起敏和吴远恒是下卷的主审。此外参加本书的编者还有姚明广、李光、赵刚、李丹、杨凤茹、郭智慧、缪莹等同志，他们承担本书编写前期大量的资料收集、筛选、编译和校对工作。

在编写过程中，我们参阅了国内外出版的大量有关资料和信息，主要参考文献目录附于书末。在此，谨表诚挚的谢意。

由于编者水平有限，疏忽之处实属难免，恳请学界同仁和读者批评指正。

我们的 E-mail 地址是：mgyao2003@163.com。

编　者

2004 年 7 月于上海

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新编电力英语教程(第7册)

电力科技英语

Scientific and Technical English for Electric Power

主　编　涂和平

副主编　(按姓氏笔画)

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编 写 说 明

目前，电力系统的广大员工都在学习英语，但是，作为具有一定英语基础的电力英语学习者，如何才能在电力专业领域的英语学习更上一层楼呢？为此，在编写《新编电力英语教程》的过程中，《电力科技英语》就成为了其中的重要内容之一。

《电力科技英语》共分 9 个单元，每个单元选取 2 篇文章，内容涉及当前电力科技的诸多领域。考虑到电力英语在内容上专业性较强，为了调节学习气氛，每篇文章选材力求通俗、实际、实用。通过从词汇、句型、结构、语法等不同角度，紧密结合电力英语的特点来学习本书，能够熟悉常用的电力科技词汇，了解当前电力市场的形势与前沿。

同样，作为检验学习效果的手段，每个单元配备了一定量的练习。练习的编写也力求做到实用。

本册书不仅是广大电力行业人员使用的良好读物，也是广大电力专业在校师生的教学用书。

尽管本册书的选材、整理与编写工作暂时告一段落，但书中难免出现有因编者(不是科技工作者)水平有限、时间仓促等造成的诸多不尽如人意之处，敬请读者朋友不吝批评并予以指正。

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Part 1

Unit 1

Text A Electric Power System

As the power industry grows, so do the economic and engineering problems connected with the generating, transmission and distribution systems used to produce and handle the vast quantities of electrical energy consumed today①. These systems together form an electrical power system.

It is important to note that the industry that produces electrical energy is unique in that it manufactures its product at the very instant that it is required by the customer②. Energy for the generation of electricity can be stored in the form of coal and oil, and of water in reservoirs and lakes, to meet future requirements, but this does not decrease the need for generator capacity to meet the customers' demands.

It is obvious that the problem of the continuity of service is very important for a electrical power system. No service can be completely protected from the possibility of failure and clearly the cost of the system will depend on its reliability. A balance must therefore be struck between reliability and cost; and the final choice will depend on the size of the load, its character, the source of possible interruptions and the user's requirements. However a net reliability gain is obtained by employing a certain number of generating units and by using automatic breakers for the separation into sections of the bus bars in generating stations and of the .transmission lines in a national or international grid system. In fact a large system comprises numerous generating stations and loads interconnected by high-capacity transmission lines. An individual unit of generation or set of transmission 'lines can usually cease to function without interrupting the general service.

The most usual system today for generation and for the general transmission of power is the three-phase system. In favor of this system are its simplicity and its saving with respect to other a. c. systems③. In particular, for a given voltage between conductors, with a given power transmitted, with a given distance, and with a given line loss, the three-phase system requires only 75 per cent of the copper or aluminium needed in the single-phase system. Another important advantage of the three-phase system is that three-phase motors are more efficient than single-phase ones. The sources of energy for large-scale electricity generation are:

1. steam obtained by means of a conventional fuel (coal, oil or natural gas), the combustion of city refuse or the employment of nuclear fuel;

2. water;

3. diesel power from oil.

There are other possible sources of energy such as direct solar heat, wind power, tidal power, etc., but none of these has yet gone beyond the pilot-plant stage.

In large steam power plants, the thermal energy stored in steam is converted into work by means of turbines. A turbine consists essentially of a shaft or rotor fixed in bearings and enclosed in a cylindrical casing. The rotor is made to turn smoothly by means of jets of steam from nozzles around the periphery of the turbine cylinder. These steam jets strike blades attached to the shaft. Central power stations employ condensing turbines in which the steam passes into a condenser after leaving the turbine. Condensation is effected by the circulation of large quantities of cold water through the tubes of the condenser, thus increasing the expansion ratio of the steam and the consequent efficiency and work output of the turbine. The turbines are connected directly to large electricity generators.

In turbines the action of the steam is kinetic. There is progressive expansion of the steam from the high pressure and relatively small volume at which it enters the turbine to the low pressure and relatively very great volume at which it leaves.

Steam is made by heating water in a boiler. The usual boiler has a furnace in which fuel is burned, and the heat given off during combustion is conducted through the metal walls of the boiler to generate steam at a pressure within the boiler vessel. In nuclear plants, steam is generated with the aid of a reactor in which the controlled fission of uranium or plutonium supplies the necessary heat for the vaporization of water. Thus the reactor replaces the steam generator of conventional plants.

Use is made of the energy possessed by water in hydroelectric stations. In order to transform this energy into work, hydraulic turbines are used. Modern hydraulic turbines may be divided into two classes: impulse turbines and pressure or reaction turbines. Of the former, the Pelton wheel is the only type used in important installations; of the latter, the Francis turbine or one of its modifications is universally employed.

In an impulse turbine, the whole head of water is converted into kinetic energy before the wheel is reached, as the water is supplied to the wheel through a nozzle. In the pressure or reaction turbine the wheel (or runner) is provided with vanes into which water is directed by means of a series of guide vanes around the whole periphery. The water leaving these guide vanes is under pressure and supplies energy partly in the kinetic form and partly in the pressure form.

The diesel engine is an excellent prime mover for electricity generation in plant below about 10,000 KVA. It has the advantage of low fuel cost, a brief warming-up period and low standing losses. Moreover it requires little cooling water. Diesel generation is generally chosen for small power requirements by municipalities, hotels and factories; hospitals often keep an independent diesel generator for emergency supply.

The transmission of electrical energy by means of lines is a great problem in electrical power systems. Transmission lines are essential for three purposes:

1. To transmit power from a hydroelectric site to a load center perhaps a considerable distance away;

2. For the bulk supply of power from steam stations to load centers a relatively short distance away;

3. For interconnection purposes to transfer energy from one system to another in case of emergency.

The transmission voltage is determined largely by economic factors. In fact, in a transmission line, if the distance, the power and the power loss are fixed, the total weight of the conductor varies inversely as the square of the transmission voltage. For the economic transmission of power over considerable distances the voltage must therefore be high. Naturally with higher voltages the insulation cost also rises and to find the optimum voltage we must strike a balance between this cost and the saving through the reduction of the cross-section of the conductors.

For high voltages, overhead-line construction is generally used with suspension-type insulators. Steel tower, called pylons, serve to carry the insulators, with each conductor suspended from the bottom of a group or string of insulator units. The following types of conductor are those most commonly used: stranded copper conductors, hollow copper conductors and ACSR (aluminum cable, steel reinforced) conductors.

Distribution includes all the parts of the electricity system between the power substations supplied from high-voltage transmission lines and the consumer's switch. Electric power is received from substations and distributed to the consumers at the voltage levels and with the degree of continuity that are acceptable to the various types of consumer. In large metropolitan systems both overhead and underground distribution methods are used. Although underground distribution is more expensive than an overhead system, it is virtually a necessary in heavily urbanized areas. In smaller towns and in the less congested districts of large cities, the entire distribution system is usually overhead.

Notes

① As the power industry grows, so do the economic and engineering problems connected with the generating, transmission and distribution systems used to produce and handle the vast quantities of electrical energy consumed today.

句中 so do the economic and engineering problems connected with the generating…是一个倒装句，so 是“也”的意思，do 代替前面句中出现过的动词 grow，如：He likes music very much, so do I。

② It is important to note that the industry that produces electrical energy is unique in that it manufactures its product at the very instant that it is required by the customers.

要正确理解这个句子，首先要弄清句中四个 that 的作用，第一个 that 引导的是一个宾语从句，作动词 note 的宾语，第二个 that 引导的是定语从句，修饰 industry，第三个 in that 是一个固定搭配，意思是“因为”，在此处作状语修饰 unique，第四个 that 引导定语从句修饰 the very instant。

③ In favor of this system are its simplicity and its saving with respect to other a. c. systems.

本句是一个倒装句，主语是 its simplicity and its saving，谓语部分是 are in favor of this system，而 with respect to 是一个固定搭配，意思是“相对于……”。

Technical Terms

1. automatic breaker	自动断路器
2. bus bars	汇流排
3. grid system	(电)网
4. single-phase system	单相系统
5. three-phase motor	三相电机
6. city refuse	城市垃圾
7. pilot-plant stage	试点电站阶段
8. steam power plant	蒸汽发电站
9. nozzle	喷嘴
10. periphery	外围
11. turbine cylinder	涡轮汽缸
12. steam jets	蒸汽喷射流
13. expansion ratio	膨胀率
14. work output	输出功率
15. metal walls	金属壁
16. boiler vessel	锅炉体
17. reactor	反应堆
18. plutonium	钚
19. hydroelectric station	水电站
20. hydraulic turbine	水轮机
21. impulse turbine	脉冲式涡轮
22. pressure (reaction) turbine	压力(反应)式涡轮
23. head of water	水头
24. guide vane	引导叶片
25. standing loss	标准损耗
26. municipality	市政
27. load centre	负载中心
28. bulk supply	批量供应
29. transmission voltage	传输电压
30. insulation cost	绝缘成本
31. optimum voltage	最佳电压
32. strike a balance between	找到平衡
33. overhead-line construction	高架结构
34. suspension-type	悬挂式
35. pylon	路标塔
35. ACSR	钢芯铝线

Useful Phrases

1. be connected with	与……有联系；与……有关系
2. the vast/large quantities of	大量的
3. in the form of	以……形式
4. strike the balance between	在两者之间找到平衡点
5. depend on	依靠，依赖
6. in favor of	赞成；支持
7. in particular	特别
8. with the aid of	在……的帮助/援助下

Exercises

I. Decide whether the following statements are true or false.

1. Distribution systems are also called the electrical power system.
2. It is possible for an individual set of transmission lines to cease to function without affecting the general service.
3. With the help of turbines the heat energy stored in steam can be converted into work.
4. Pelton wheel, a type of reaction turbines, is used only in important installations.
5. In a transmission line, if other factors remain fixed, the weight of the conductor is inversely proportional to the transmission voltage.
6. As underground distribution is more expensive than an overhead system, it is not used in practice.

II. Translate the following sentences into English.

1. 电力工业是一个独特的行业，因为它必须生产产品按顾客的要求即需即用。
2. 电能可以多种形式储存，如煤、油水等等。
3. 企业必须在产品质量和生产成本之间找到平衡点。
4. 太阳能，风能，潮汐能都被称为清洁能源。
5. 现代水轮机可分为脉冲式和压力式两种。
6. 在电力系统的设计及运行中，电费是首先要考虑的。

III. Translate the following passage into Chinese.

A great amount of effort is necessary to maintain an electric power supply within the requirements of various types of customers served. Large investments are necessary, and continuing advancements in methods must he made as loads steadily increase from year to year. Some of the requirements for electric power supply are recognized by most customers, such as proper voltage, availability of power on demand, reliability, and reasonable cost. Other characteristics, such as frequency, wave shape, and phase balance, are seldom recognized by the customers but are given constant attention by the utility power engineers.

Text B Electric System Monitoring

A modern electric power system is an assembly of many components each of which influences the behavior of every other part. Proper functioning of the system as a whole makes it necessary to monitor conditions existing at many different points on the system in order to assure optimum operation.

The concern of the customers is primarily that the frequency and voltage of the supply are held within certain rather narrow limits. Since frequency of the system is the same everywhere, it may be monitored by a single frequency meter located at any convenient point. In contrast the voltage of the system may be quite different at different points. Consequently, it is necessary to make continuous observation of the voltage at certain key points on the system in order to provide acceptable service.

Efficient operation of the system is obtained by assigning proper load schedules to each of the generators on the system. Newer plants, although individually more efficient, may be located at points on the system where their loading occasions large system losses. It is desirable to operate with a division of the load between generators so that the total cost of fuel consumed is minimized①. To provide reliability of the power supply in tile event of unexpected conditions, it is desirable to have the total kilowatt rating of all machines in operation somewhat greater than the total load plus losses. This excess of generation, known as spinning reserve, is then available for picking up suddenly applied customer loads or to pick up the load dropped by a generator that must be removed from service for emergency maintenance.

Instrumentation is necessary to permit billing of Customers for energy used. Many interconnections exist between different power systems. Instruments must be provided at interchange points to permit billing for energy transferred from one system to another. The continuous monitoring of energy transfer is necessary to assure that interchanged power is within the limits of contract agreements.

The continuous measurement of conditions on major pieces of equipment is necessary to avoid damage due to overload. As load increases from month to month, points at which additional capacity of equipment is required may be recognized and provision made for the installation of additional equipment. Thus instrumentation serves as a guide for future construction in a growing power system.

Occasionally, under emergency conditions, a system operator observes that his system load exceeds the ability of the available generating and transmission equipment. He is then faced with the problem of load shedding or, more properly, load conservation②. It is then necessary to drop selected loads where service interruption is least objectionable. In such an event, he relies on the many instruments which provide information relative to system-operation conditions.

Instruments may sound alarms as advance warnings of conditions requiring action to avoid damage to equipment operating beyond its design limitation. In the event of extreme conditions such as power-system faults, defective equipment is switched out of service automatically. Instruments that continuously mouitor current voltage, and other quantities must be able to

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