

天景图书

# 机电工程英语

## 阅读教程

主编 乔小六 李士芹

Mechanical & Electrical Engineering

 天津大学出版社  
TIANJIN UNIVERSITY PRESS

# 机电工程英语阅读教程

主 编 乔小六 李士芹

副主编 孙梓健 徐 斌

编 者 龚玲莉 李家才 姚毓齐

杨春春 陈斌梅 张素娣

 天津大学出版社  
TIANJIN UNIVERSITY PRESS

### 图书在版编目(CIP)数据

机电工程英语阅读教程/乔小六,李士芹编著. —天津:天津大学出版社,2008.9

ISBN 978-7-5618-2766-6

I.机… II.①乔… ②李… III.机电工程—英语—阅读教学—高等学校:技术学校—教材 IV.H319.4

中国版本图书馆 CIP 数据核字(2008)第 131086 号

出版发行 天津大学出版社  
出 版 人 杨欢  
地 址 天津市卫津路 92 号天津大学内(邮编:400072)  
电 话 发行部:022-27403647 邮购部:022-27402742  
网 址 www.tjup.com  
短信网址 发送“天大”至 916088  
印 刷 昌黎太阳红彩色印刷有限责任公司  
经 销 全国各地新华书店  
开 本 185mm × 260mm  
印 张 18  
字 数 585 千  
版 次 2008 年 9 月第 1 版  
印 次 2008 年 9 月第 1 次  
印 数 1 - 2 000  
定 价 29.80 元

---

凡购本书,如有缺页、倒页、脱页等质量问题,烦请向我社发行部门联系调换

版权所有 侵权必究

# 前 言

随着我国机械、电力行业逐步同国际接轨，国家对既精通英语又掌握一定工程技术知识的复合型、应用型人才的需求也日益增加。而目前市场上专业英语教材覆盖面过窄、知识点过细、不成体系，无法满足广大文科学生和高职高专相关专业学生的学习要求。为此，我们编写了针对机电行业的《机电工程英语阅读教程》。

本教材分两大部分，第一部分为“机械工程英语”，第二部分为“电力工程英语”。每部分各包括十个单元，每单元有 A、B、C 三篇文章。其中 A、B 篇为精读文章，配备相应练习；C 篇供学生课后拓展阅读。

本教材由多位长期在教学一线的资深英语教师和相关专业教师编写，内容从学生的实际情况出发，充分考虑了学生在学习进程中可能遇到的各种困难，各单元注重图文并茂，变复杂枯燥为简单易学。

本教材属于专门用途英语（ESP），注意与一般性的科普读物和专业英语相区分，可供工程类院校的英语专业和其他文科类专业的本科生或高职高专机电专业学生使用，亦可供机械、电力从业人员参考。

本书内容虽经反复推敲、仔细斟酌，但由于编者水平有限，疏漏和不当之处在所难免，欢迎读者不吝指正，以便我们不断改进。

编 者  
2008 年 8 月

# 目 录

## 第一部分 电力工程英语

Unit 1	A Brief Introduction to World Power.....	2
	Section A World Electric Power Systems.....	2
	Section B Power Failures.....	7
	Section C Hazards to Power System Operation.....	13
Unit 2	A Brief Introduction to China's Power.....	16
	Section A China Electrical Power Equipment Industry Report, 2007.....	16
	Section B Reformation of China's Power Industry.....	21
	Section C Three Gorges, China.....	25
Unit 3	Components of Power System.....	31
	Section A Evolution of Electric Power Systems.....	31
	Section B Components of Power System.....	38
	Section C Power System Control.....	43
Unit 4	Thermal Power Plant.....	50
	Section A How Does a Thermal Power Plant Work.....	50
	Section B Turbine Proper and HP Turbine.....	55
	Section C Turbine and Generator.....	60
Unit 5	Hydroelectric Power Plants.....	63
	Section A Hydroelectricity.....	63
	Section B Hydroelectricity and Desirable Feature of Hydroplant.....	67
	Section C The Three Gorges Dams Project.....	72
Unit 6	Nuclear Power Plant.....	75
	Section A Nuclear Power in the World Today.....	75
	Section B The Nuclear Fission Power Plant.....	80
	Section C Nuclear Power Plant Emergency.....	86
Unit 7	Substation and Its Automation.....	89
	Section A Substation.....	89
	Section B Coordination in Substation Automation System.....	94



	Section C ABB Provides Power Equipment to CCTV New Site .....	98
Unit 8	Power System Protection .....	101
	Section A A Brief Introduction to the Protection System .....	101
	Section B Protection Philosophy and Relay Failures .....	106
	Section C Relay Uses .....	110
Unit 9	Communication in Electric Power System .....	116
	Section A Communication in Electric Power System .....	116
	Section B Power Line Carrier Communication .....	120
	Section C China's Links with World Expand through Giant Cable .....	125
Unit 10	Power Transmission and Distribution .....	127
	Section A HVDC Transmission .....	127
	Section B Switches .....	132
	Section C Cables .....	137

## 第二部分 机械工程英语

Unit 11	Fundamentals of Mechanical Engineering .....	142
	Section A Introduction to Machines .....	142
	Section B Mechanism .....	147
	Section C Bearing .....	153
Unit 12	(CAD / CAM) Mechanical Design .....	155
	Section A Machine Design .....	155
	Section B CAD / CAM .....	160
	Section C Mechanical Design Process and Contents of Mechanical Design .....	166
Unit 13	Machining Technology .....	169
	Section A Introduction to Machine Tools and Basic Conventional Machine Tools .....	169
	Section B Machinability and Steels .....	174
	Section C High-speed Machining .....	179
Unit 14	Manufacturing Engineering and Technology .....	182
	Section A What is Manufacturing .....	182
	Section B Manufacturing Technology .....	187
	Section C The Computer and Manufacturing .....	193
Unit 15	Mechanical Engineering Materials .....	196
	Section A Introduction to Materials .....	196
	Section B Material Selection .....	201
	Section C Metals and Ferrous Metals .....	207



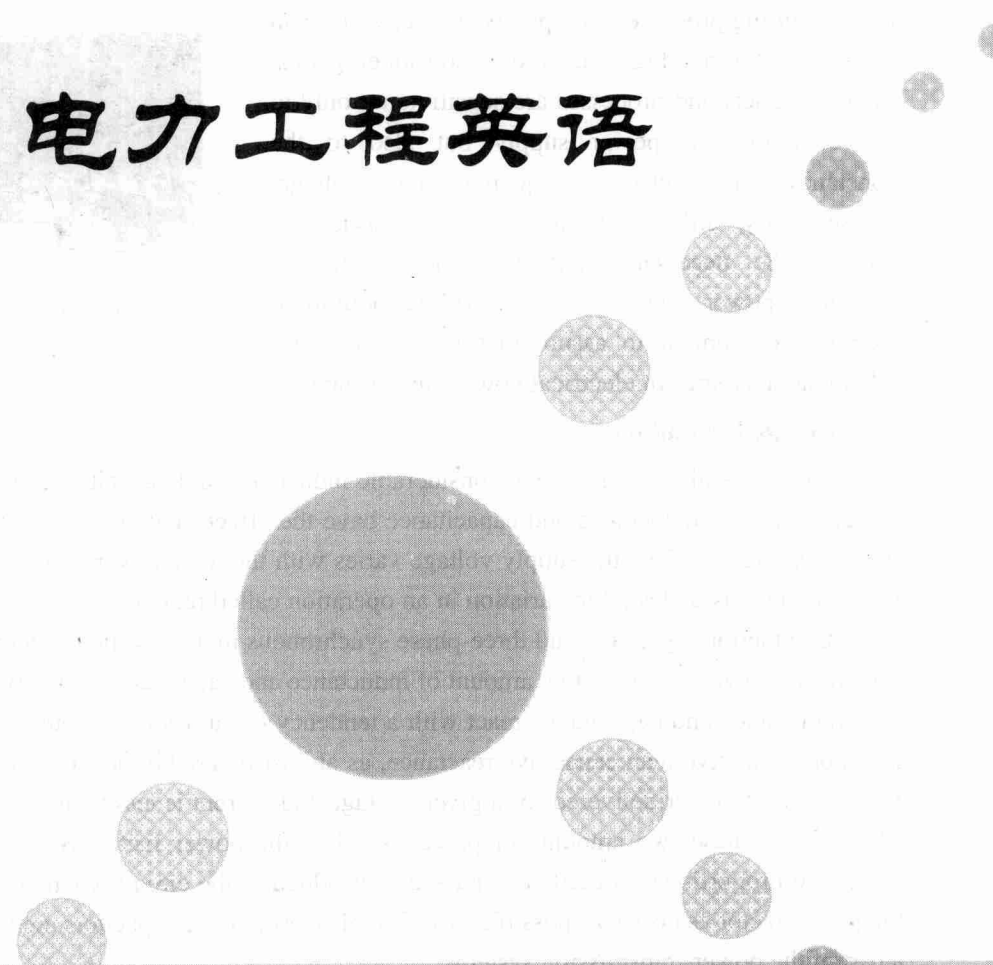
---

Unit 16	Mold Manufacture Technology .....	211
Section A	Mold Design and Construction (I) .....	211
Section B	Mold Design and Construction (II).....	216
Section C	Forging .....	221
Unit 17	Hydraulic & Pneumatic Technology .....	225
Section A	Hydraulics & Pneumatics .....	225
Section B	Hydraulic System .....	230
Section C	E-mail Blood Samples .....	237
Unit 18	Numerical Control Technology of Mechanical Equipment .....	240
Section A	What is CNC.....	240
Section B	The CNC Programs .....	245
Section C	Types of CNC Machines.....	250
Unit 19	Car Manufacturing Technology .....	253
Section A	The Automobile Transmission .....	253
Section B	Anti-lock Brake System .....	259
Section C	Modern Automobile Manufacturing .....	264
Unit 20	Computer Measurement & Control Technology.....	267
Section A	A Control System.....	267
Section B	Industrial Robot.....	273
Section C	Process Supervision via Artificial Intelligence Techniques .....	279

Part 1 A Brief Introduction  
to World Power

# 第一部分

# 电力工程英语



Over the period from 1970 to 2001, the total amount of power for which the electricity supply  
annual world electric power production and consumption rose from 1.1 million



# Unit 1 A Brief Introduction to World Power

## Section A World Electric Power Systems

In recent years electricity has been used to power more sophisticated and technically complex manufacturing processes, computers and networks, and a variety of other high-technology consumer goods. These products and processes are sensitive not only to the continuity of power supply but also to the constancy of electrical frequency and voltage. Consequently, utilities are taking new measures to provide the necessary reliability and quality of electrical power, such as by providing additional electrical equipment to assure that the voltage and other characteristics of electrical power are constant.

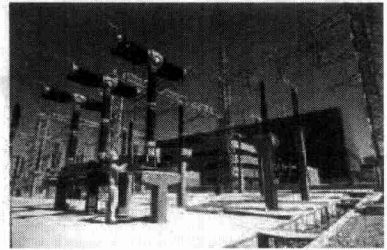


Fig.1 Photo credit: Callifornia Energy  
commission

### Voltage Regulation

Long transmission lines have considerable inductance and capacitance. When a current flows through the line, inductance and capacitance have the effect of varying the voltage on the line as the current varies. Thus the supply voltage varies with the load. Several kinds of devices are used to overcome this undesirable variation in an operation called regulation of the voltage. The devices include induction regulators and three-phase synchronous motors (called synchronous condensers), both of which vary the effective amount of inductance and capacitance in the transmission circuit.

Inductance and capacitance react with a tendency to nullify one another. When a load circuit has more inductive than capacitive reactance, as almost invariably occurs in large power systems, the amount of power delivered for a given voltage and current is less than when the two are equal. The ratio of these two amounts of power is called the power factor. Because transmission-line losses are proportional to current, capacitance is added to the circuit when possible, thus bringing the power factor as nearly as possible to 1. For this reason, large capacitors are frequently inserted as a part of the power-transmission systems.

### World Electric Power Production

Over the period from 1950 to 2003, the most recent year for which data are available, the annual world electric power production and consumption rose from slightly less than 1 trillion



kilowatt-hours (kWh) to 15.9 trillion kWh. A change also took place in the type of power generation. In 1950 about two thirds of the world's electricity came from steam-generating sources and about one third from hydroelectric sources. In 2003 thermal sources produced 65% of the power, but hydropower had declined 17%, and nuclear power accounted for 16% of the total. The growth in nuclear power slowed in some countries, notably the United States, in response to concerns about safety. Nuclear plants generated 20% of U.S. electricity in 2003; in France, the world leader, the figure was 78%. Much of the world's electricity is produced from the use of nonrenewable resources, such as natural gas, coal, oil, and uranium.

Coal, oil, and natural gas contain carbon, and burning these fossil fuels contributes to global emissions of carbon dioxide and other pollutants. Scientists believe that carbon dioxide is the principal gas responsible for global warming, a steady rise in the Earth's surface temperature. Consumers of electricity can save money and help protect the environment by eliminating unnecessary use of electricity, such as turning off lights when leaving a room. Other conservation methods include buying and using energy-efficient appliances and light bulbs, and using appliances, such as washing machines and dryers, at off-peak production hours when rates are lower. Consumers may also consider environmental measures such as purchasing "Green Power" when it is offered by a local utility. "Green power" is usually more expensive but relies on renewable and environmentally friendly energy sources, such as wind turbines and geothermal power plants.

## Words and Expressions

sophisticated

voltage

transmission

inductance

capacitance

load

nullify

transmission-line

trillion

hydroelectric

utility

electric frequency

induction regulator

synchronous condenser

inductive reactance

capacitive reactance

three-phase synchronous motor

*a.* 非常尖端或复杂精密的

*n.* 电压

*n.* 传输

*n.* 电感

*n.* 电容

*n.* 负荷, 负载

*v.* 使无效, 废除, 抵消

传输线

*a.* 万亿的, 兆的

*a.* 水力发电的

*n.* 公用事业 (供电公司)

电频

电感调节器

同步调相机

感抗

容抗

三相同步电动机



## Notes

1. When a load circuit has more inductive than capacitive reactance, as almost invariably occurs in large power systems, the amount of power delivered for a given voltage and current is less than when the two are equal.

当一个负载线路的感抗大于容抗时，则给定电压和电流的输送功率要小于感抗和容抗相等时的。这一情况几乎总是发生在大型电力系统内。

分析：句中 *as almost invariably occurs in large power systems* 是插入语，补充说明前一句的情况在大型电力系统内经常发生。

2. Over the period from 1950 to 2003, the most recent year for which data are available, annual world electric power production and consumption rose from slightly less than 1 trillion kilowatt-hours (kWh) to 15.9 trillion kWh.

从1950年到2003年（2003年为可获取资料的最近一年），世界每年的发电量和消耗量从低少于1兆千瓦时上升到15.9兆千瓦时。

分析：句中 *the most recent year for which data are available* 是插入语，表示可以获取到资料的最近年份是2003年。

3. The growth in nuclear power slowed in some countries, notably the United States, in response to concerns about safety.

出于安全因素的顾虑，核电在一些国家尤其在美国，缓慢地发展着。

分析：句中 *notably the United States* 是插入语。*in response to* 指“回答，答复”。  
e.g. In response to your inquiry... 兹答复您所询问的……

## Exercises

### I. Single Choices

- The main idea of this passage is \_\_\_\_\_.
  - the introduction of world electric power production
  - the voltage regulation
  - the new type of electric power production
  - both A and B
- Capacitance can be added to the circuit when possible because \_\_\_\_\_.
  - the power factor is as near as possible to 1
  - transmission-line losses are proportional to current
  - large capacitors are frequently inserted as a part of power-transmission systems
  - inductance and capacitance react with a tendency to nullify one another
- The main reason for the slow development of nuclear power is the \_\_\_\_\_.
  - technology limit
  - people's worry



- C. limited time
- D. money shortage
- 4. If you want to help protect the environment, you can use your washing machine at \_\_\_\_\_.  
A. 10 a.m.            B. 2 p.m.            C. 4 p.m.            D. 10 p.m.
- 5. According to the text, which country is the leader in the production of nuclear power?  
A. U.S.A.            B. Japan.  
C. France.            D. Not given.

**II. Blank Filling**

transmission	efficiently	resistance	neighborhood	convert
transformer	eventually	boost	appliance	substation

The electricity first goes to a   1   at the power plant that   2   the voltage up to 400,000 volts. When electricity travels long distances it is better to have it at higher voltages. Another way of saying this is that electricity can be transferred more   3   at high voltages.

The long thick cables of   4   lines are made of copper or aluminum because they have a low   5  . The higher the resistance of a wire, the warmer it gets. So, some of the electrical energy is lost because it is changed into heat energy. High voltage transmission-lines carry electricity long distances to a   6  .

The power lines go into substations near businesses, factories and homes. Here transformers change the very high voltage electricity back into lower voltage electricity.

From these substations, electricity in different power levels is used to run factories, streetcars and mass transit, light street lights and stop lights, and is sent to your neighborhood.

In your   7  , another small transformer   8  , on pole or in a utility box converts the power to even lower levels to be used in your house. The voltage is   9   reduced to 220 volts for larger   10  , like stoves and clothes dryers, and 110 volts for lights, TVs and other smaller appliances.

**III. Give Definitions to the Following Terms**

- 1. inductance
- 2. capacitor and capacitance

**IV. Questions and Answers**

- 1. According to the text, in which respects has electricity been used?
- 2. What is the main function of induction regulators and three-phase synchronous motors?
- 3. In which respects there are the changes of world electric production?
- 4. Can you list some examples of using electricity properly to protect environment?
- 5. What is the "green power" offered by some local utilities?

**V. Translation**

- 1. The electrical load on the generator may be lights, motors, heaters, or other devices, alone



- or in combustion.
2. 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.
  3. When a circuit breaker opens to de-energize a piece of equipment, one side of the circuit breaker usually remains energized, as it is connected to operating equipment.
  4. Verification of proper operating voltages, current, and power indicate that at least the system has an operational power supply and that power regulation circuits are operating correctly.
  5. When a fuse (or a circuit breaker) “blows” or “trips”, something is wrong with an appliance or something was short-circuited.

## Key to the exercises

---

### I. Single Choices

1. D                      2. B                      3. B                      4. D                      5. C

### II. Blank Filling

1. transformer              2. boosts              3. efficiently              4. transmission  
5. resistance              6. substation              7. neighborhood              8. mounted  
9. eventually              10. appliances

### III. Give Definitions to the Following Terms

1. The magnetic field that is generated when a current is passed through an inductor, typically a wire coil. Inductance is measured in henrys (H).
2. A capacitor is a passive electronic component that stores energy in the form of an electrostatic field. In its simplest form, a capacitor consists of two conducting plates separated by an insulating material called the dielectric. The capacitance is directly proportional to the surface areas of the plates, and is inversely proportional to the separation between the plates. Capacitance also depends on the dielectric constant of the substance separating the plates.

### IV. Questions and Answers

1. Electricity has been used to power more sophisticated and technically complex manufacturing processes, computers and networks, and a variety of other high-technology consumer goods.
2. Both of them can vary the effective amount of inductance and capacitance in the transmission circuit.
3. The respects of electric power production and consumption, the type of power generation.
4. We can help protect the environment by eliminating unnecessary use of electricity, such as turning off lights when leaving a room. Other conservation methods include buying and using



energy-efficient appliances and light bulbs, and using appliances, such as washing machines and dryers, at off-peak production hours when rates are lower. Besides, we can purchase “green power” when it is offered by a local utility.

5. “Green power” is usually more expensive but relies on renewable and environmentally friendly energy sources, such as wind turbines and geothermal power plants.

## V. Translation

1. 电力负荷可能是单一的白炽灯、电动机、加热器以及其他一些设备或是它们的组合。
2. 为使系统作为整体能够适当的运转,有必要对系统中许多不同位置的情况进行监控,从而确保系统最佳运转。
3. 当断路器跳闸,使一台设备断电时,断路器一侧仍然带电,因为它与运行设备是相连的。
4. 能够确认正确操作电压、电流、功率是正常的,这一点可以表明系统至少有一个可供系统运行的功率供应,也表明功率的调节电路是正常运行的。
5. 当保险丝(或断路器)熔断或自动跳开时,设备应当是出现故障或短路了。

## Section B Power Failures

In most parts of the world, local or national electric utilities have joined in grid systems. The linking grids allow electricity generated in one area to be shared with others. Each utility that agrees to share with others gains an increased reserve capacity, use of larger, more efficient generators, and the ability to respond to local power failures by obtaining energy from a linking grid.

These interconnected grids are large, complex systems that contain elements operated by different groups. These systems offer the opportunity for economic savings and improve overall reliability, but they can create a risk of widespread failure. For example, a major grid-system breakdown occurred on November 9, 1965 in east of North America, when an automatic control device that regulates and directs current flow failed in Queenston, Ontario, causing a circuit breaker to remain open, a surge of excess current was transmitted through the northeastern United States. Generator safety switches from Rochester, New York, to Boston, Massachusetts, were automatically tripped, cutting generators out of the system to protect them from damage. Power generated by more southerly plants rushed to fill the vacuum and overloaded these plants, which automatically shut themselves off. The power failure enveloped an area of more than 200,000 sq km (80,000 sq mi), including the cities of Boston; Buffalo, New York; Rochester, New York; and New York City.

Similar grid failures, usually on a smaller scale, have troubled systems in North America and elsewhere. On July 13, 1977, about 9 million people in the New York City area were once again without power when major transmission-lines failed. In some areas the outage lasted 25 hours as



restored high voltage burned out equipment. These major failures are termed blackouts.

The worst blackout in the history of the United States and Canada occurred on August 14, 2003, when 61,800 megawatts of electrical power was lost in an area covering 50 million people (One megawatt of electricity is roughly the amount needed to power 750 residential homes.). The blackout affected such major cities as Cleveland, Detroit, New York, Ottawa, and Toronto. Parts of the eight states— Connecticut, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Vermont—and the Canadian Provinces of Ontario and Québec were affected. The blackout prompted calls to replace aging equipment and raised questions about the reliability of the national power grid.

The term brownout is often used for partial shutdowns of power, usually deliberate, either to save electricity or as a wartime security measure. From November 2000 to May 2001 California experienced a series of planned brownouts to groups of customers, for a limited duration, in order to reduce total system load and avoid a blackout due to alleged electrical shortages. However, an investigation by the California Public Utilities Commission into the alleged shortages later revealed that five energy companies withheld electricity they could have produced. In 2002 the commission concluded that the withholding of electricity contributed to an “unconscionable, unjust, and unreasonable electricity price spike”. California state utilities paid \$20 billion more for energy in 2000 than in 1999 as a result, the head of the commission found.

The commission also cited the role of the Enron Corporation in the California brownouts. In June 2003 the Federal Energy Regulatory Commission (FERC) barred Enron from selling electricity and natural gas in the United States after conducting a probe into charges that Enron manipulated electricity prices during California’s energy crisis. In the same month the Federal Bureau of Investigation arrested an Enron executive on charges of manipulating the price of electricity in California. Two other Enron employees, known as traders because they sold electricity, had pleaded guilty to similar charges.

Despite the potential for rare widespread problems, the interconnected grid system provides necessary backup and alternate paths for power flow, resulting in much higher overall reliability than is possible with isolated systems. National or regional grids can also cope with unexpected outages such as those caused by storms, earthquakes, landslides, and forest fires, or due to human error or deliberate acts of sabotage.



*Fig.2 People look at a series of Hydro-Quebec high voltage towers near St-Bruno, Quebec, Canada, south of Montreal that collapsed after a severe ice storm hit southwest Quebec. The storm left more than 1.4 million households out of electricity.*

*Photo credit: Jacques Boissinot / CP PHOTO*



## Words and Expressions

grid	<i>n.</i> 网状物; 高压输电线路网
reserve capacity	备用容量
savings	<i>n.</i> 储蓄
breakdown	<i>n.</i> (电力) 衰竭
circuit breaker	断路器
safety switch	安全开关
trip	<i>v.</i> 使失足, 使犯错; 使发现错误
power failure	停电
outage	<i>n.</i> 减耗量; 断供
blackout	<i>n.</i> 停电
brownout	<i>n.</i> 部分灯火管制
alleged	<i>a.</i> 被断言的, 被说成的
spike	<i>n.</i> 钉
probe	<i>n.</i> (~into) 调查
backup	<i>a.</i> 额外的, 替补的
landslide	<i>n.</i> 塌方
sabotage	<i>n.</i> 蓄意破坏, 暗中破坏
California Public Utilities Commission	加利福尼亚州公共事业委员会
Federal Energy Regulatory Commission (FERC)	美国联邦能源监管委员会
Enron	安然公司

## Notes

1. In June 2003 the Federal Energy Regulatory Commission (FERC) barred Enron from selling electricity and natural gas in the United States after conducting a probe into charges that Enron manipulated electricity prices during California's energy crisis.

在深入调查了对于安然公司在加州能源危机中操纵电价的指控后, 2003年6月, 美国联邦能源监管委员会禁止安然公司销售电力和天然气。

**分析:** that Enron manipulated electricity prices during California's energy crisis 是定语从句, 修饰 charges。conducting a probe into sth. 表示开展对某事的调查。例如:

The court decided to conduct a probe into the two officials' bribery.

法庭决定对这两名官员的受贿事件进行调查。





2. Two other Enron employees, known as traders because they sold electricity, had pleaded guilty to similar charges.

另两名因为售电而为人所知的安然雇员也因类似的指控获罪。

分析: known as traders because they sold electricity 是插入语, 补充说明这两名雇员的身份。

3. Despite the potential for rare widespread problems, the interconnected grid system provides necessary backup and alternate paths for power flow, resulting in much higher overall reliability than is possible with isolated systems.

尽管有可能发生少有的大范围故障, 互连的电网对于电力流通却提供了必要的可供选择的线路, 这样其整体可靠性要远远高于仅是独立系统的可靠性。

分析: than is possible with isolated systems 是省略结构, 其补充后应为 than (the reliability) is possible with isolated systems.

## Exercises

### I. Single Choices

- The passage mainly tells us \_\_\_\_\_.
  - current flow in the grid
  - Enron's manipulation of electricity prices during California's energy crisis
  - the cause of power failures
  - several serious power failures in North America and their influence
- Each utility which agrees to join the grid can \_\_\_\_\_.
  - get free electricity
  - be rewarded better equipments and keep them
  - obtain energy from a linking grid in case of local power failures
  - gain the praise from the government
- The worst blackout in the history of the United States and Canada happened in \_\_\_\_\_.
 

A. 2003	B. 1977
C. 2000~2001	D. 1965
- The author's attitude towards Enron can be inferred as \_\_\_\_\_.
 

A. sympathetic	B. critical
C. neutral	D. sarcastic
- The interconnected grid system is more reliable than isolated systems mainly because \_\_\_\_\_.
  - it is larger in scale
  - it is more complex and advanced designed
  - it provides alternate paths for power flow
  - it is operated more efficiently