



## 内 容 提 要

提高英语阅读能力的关键在于大量阅读体裁多样,题材广泛的英语文章。本书是一本具有鲜明时代感、集科学性、知识性、实用性、可读性和趣味性于一体的英语读本,能帮助拓展学生的英语阅读面、知识面,让他们接触到原汁原味、鲜活生动的语言,学到最新、最地道的英语词汇和习惯表达法。

本书选用现实语言环境中的全真材料,选材广泛,涉及社会、经济、金融、历史、体育、环保、人物传略、医疗保健、科普知识等各个方面。共有10个单元,每个单元由3篇题材相近的文章组成。每篇文章均配有注释、词汇表以及形式多样、具有很强针对性的练习,以帮助学生把握文章的内容。

本书既可作为英语阅读教程,供课堂教学用,也可作为补充读物,供学生课外阅读。对象为各类非英语专业研究生,或已达大学英语四级水平的其他学生。对于具有中级英语水平的各类英语爱好者,也不失为一本非常实用的英语自学读本。

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# 前 言

我们正处在一个高速发展的信息社会,知识更新日益加快,浩如烟海的信息亟待人们去获悉、处理,而阅读是获取大量信息的最重要手段之一。在学习英语的过程中,大量的阅读实践也能帮助学生有效掌握语言知识,打好扎实的语言基础。作为体现英语综合技能的重要组成部分,英语阅读能力的提高还有助于促进英语听说能力以及写作表达能力的提升,而提高阅读这一应用能力的最有效途径,就是阅读大量体裁多样、题材广泛的英语文章。然而在现实生活中我们注意到,不少学生都存在着一个阅读量少、阅读面窄、阅读内容陈旧的问题。我们编写《研究生英语时文阅读》一书,旨在为各类非英语专业的研究生,提供一本具有鲜明的时代感、较强的科学性、知识性、实用性、可读性和趣味性的英语读物,以期进一步拓宽研究生的英语阅读范围,激发他们的阅读兴趣,让他们接触到更多鲜活生动的语言,学到最新、最地道、最贴近生活的英语词汇,从而帮助他们进一步提高英语阅读水平,学会通过阅读,快速、准确地获取所需的信息。

本书中的文章关注各类热点话题,题材广泛,体裁多样,内容涉及社会、经济、金融、科技、历史、体育、环保、医疗保健、人物传记等各领域。全书共有 10 个单元,每个单元由 3 篇题材相近的文章组成。每篇文章均配有注释、词汇表以及相关练习,以帮助学生深刻理解、全面把握文章的内容。

注释:内容包括背景知识介绍、文中出现的知名人物及部分作者简介;重要地名、机构名称及专业术语释义;对文中一些语言难点及部分难句作了必要的解释或译成汉语。

词汇表:列出文中出现的生词和词组,所列单词全部注上国际音标,便于学生掌握正确的发音。

练习:每个单元中,Passage A 和 Passage B 各配有三项练习。第一项为选择题,旨在检查学生对文章内容的理解程度,并帮助学生在阅读过程中提高分析、归纳、综合和推断的能力。第二项为猜测词义,要求学生根据上下文猜出单词大意,而不是动辄查词典,这种能力的培养也是提高阅读能力的一个重要组成部分。第三项练习为讨论题或思考题,要求学生结合文章内容或与文章内容有关的话题发表自己的见解。Passage C 配有两项练习内容:选择题和是非判断题。

书末附有练习答案,以供读者自学时参考。

本书既可作为英语阅读教程,供课堂教学用,也可作为补充读物供学生课外阅读。主要对象为各类非英语专业的研究生以及已达到大学英语四级水平的其他学生。当然对于具有中级英语水平,并想继续深造的英语爱好者,也不失为一本非常实用的英语自学读物。

限于水平和经验,书中难免有疏漏及不妥之处,敬请广大师生和读者批评指正。

编 者

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# Unit One



## *Making Energy Clean, Safe, and Affordable*

David Bittersdorf<sup>1</sup>

[ 1 ] There is a wind turbine<sup>2</sup> in your future or, more likely, many of them. From small back-yard units to tall ones on mountain ridges and rising out of the sea, wind turbines and the power they generate are expected to become major contributors to the U. S.'s energy supply. Here's why:

- Wind is local. We don't import it, ship it, or fight wars over it.
- Wind turbines make poor targets for terrorist attacks.
- Wind power can keep the lights on when all other energy sources are blacking out.
- Wind power is clean. It doesn't foul the air, water, or soil.
- Wind is renewable and plentiful. We won't run out of wind.

[ 2 ] A major obstacle in the past to wind energy has been the cost of the technology to produce it. However, since the 1970s, when Congress established the National Renewable Energy<sup>3</sup> Lab, wind energy generation costs have fallen 90%. They are now as low as four cents per kilowatt hour<sup>4</sup>, competitive with other energy sources, and are still dropping as wind projects get larger and newer technologies are used.

[ 3 ] With costs going down, interest in wind energy is moving beyond the core of "true believers" and going mainstream. More utilities are beginning to invest in wind energy and to plan for it to have a growing role in the future.

[ 4 ] Meanwhile, Europe is far ahead of the U. S. Denmark alone generates nearly 20% of its electricity from the wind. Germany and Spain are also big wind energy users. In total, there are about 35,000 wind turbines generating power

worldwide and producing 20,000,000,000 kilowatt hours each year.

- [ 5 ] A recent study in Denmark found that, by 2017, wind could provide 10% of world electricity needs and could supply 500,000,000 average European households. In the U. S. , wind has the potential to generate as much as 40% of the nation's electrical needs in the next 20 years. Yet, at present, it provides less than one percent of America's energy needs.
- [ 6 ] While the U. S. pioneered the technology, Europe has been gaining economic benefits in new production and jobs in this clean energy industry. Many countries there have government policies that support renewable energy, while U. S. energy policy still strongly favors fossil fuels<sup>5</sup>.
- [ 7 ] America has had a century of depending heavily on oil for its energy needs. In the early 1970s, about one-third of that oil came from outside of the country. Today, nearly two-thirds is imported. The U. S. exports over \$70,000,000,000 each year for oil. Dependence on these foreign sources makes America's energy supply unstable and creates national security problems. Importing oil also opens up the nation to risk of accidents and oil spills that cause significant damage to birds and marine life.
- [ 8 ] Trying to offset some of that dependence with more U. S. oil, such as that in the Arctic National Wildlife Refuge, risks destroying fragile ecosystems. Petroleum demand will outstrip supply in the first half of this century. America will need more than it can produce. Shortages will drive prices up. Instead of literally fighting for the last drop, it makes sense to shift to wind and other renewable energy sources.<sup>6</sup>
- [ 9 ] Yet, national policy still creates artificially low prices for oil with heavy government subsidies, tax credits<sup>7</sup>, depletion allowances<sup>8</sup>, and military protection of Middle East oil. For wind to pull ahead, advocates are asking Washington to provide tax credits for small wind and solar systems, adopt a renewable portfolio standard to require a minimum percentage of electricity generated to come from renewable energy sources, and increase research funding to drop the price of wind energy even further.
- [ 10 ] In his State of the Union address in January, 2002<sup>9</sup>, Pres. Bush spoke of the dangers of terrorism against public utilities, saying, " Our discoveries in Afghanistan confirmed our worst fears and showed us the true scope of our work ahead. We have found diagrams of American nuclear power plants and public water facilities . . . surveillance maps of American cities . . . "
- [ 11 ] The perceived risks of living near traditional power plants contrast sharply with the unlikelihood of wind turbines becoming targets.<sup>10</sup> Further, the possibility of attack on a traditional power plant enhances the appeal of having wind generation as part of a utility's mix.

[12] Americans' new concerns about dangers near home may also account for the recent rapid rise in "small wind". A growing number of states have "net metering" laws that allow people producing their own wind energy to plug into the power grid<sup>11</sup> serving their area and receive payment for the power they produce in the form of a credit against their electric bill.<sup>12</sup> The more people produce some of their own energy, the less demand is placed on their electric utilities. Thus, privately owned backyard turbines large enough to power a home, farm, or small business are growing in popularity. Used in combination with solar panels<sup>13</sup>, they can keep the power flowing in most kinds of weather and are practical to power a home fully with clean, renewable energy. The time it takes for people to recover their investments on these small wind units is decreasing as the technology is becoming less costly and electricity rates in general are going up. Moreover, beyond the dollars are the rewards of independently providing for one's own energy needs and contributing to cleaner air for everyone.

[13] Today, with nearly two-thirds of America's oil needs coming from outside the U. S. , dependency on foreign oil is growing and raising concerns about the stability of the nation's supplies. Drilling and transporting oil has a high cost in pollution risks, endangering birds, wildlife, beaches, and water.

[14] The human health and environmental risks of producing energy from coal are increasing. Since 1973, for example, the Federal black lung disease<sup>14</sup> benefits program has cost \$3,500,000,000, providing a clue to the human suffering.

[15] Nuclear plants generate radioactive waste without storage and transport solutions that have the confidence of most Americans. The hundreds of tons of spent fuel rods<sup>15</sup> being stored at each nuclear plant are disasters waiting to happen. It increasingly makes sense to replace these energy sources with clean renewable energy from the wind and sun. Wind energy can be as local as a homeowner's backyard. Wind turbines can power farms, businesses, and even communities. Wind farms can have a larger role as part of urban or regional energy utilities.

[16] Polling data in the U. S. and other countries show solid public support for wind energy and other clean, renewable sources. Wind's greatest vulnerability comes from concerns about its visual impact, and that varies widely. To many people, the tall towers with their slowly moving blades are beautiful. Others worry that they might intrude on landscapes, especially in scenic locations.

[17] In Vermont, for instance, Gov.<sup>16</sup> Howard Dean and the state ski areas association have endorsed a plan to place wind turbines atop the developed mountains to provide energy for ski resorts. Vermont's awesome scenery has suffered from poor visibility because of pollution from power plants. The role of



... wind energy will be to help clear the smog from the air. For most people in that state known for its care of the environment, seeing the wind turbines clearly as part of the mountain scenery will be a refreshing and proud view.

[18] Wind power is an inexhaustible energy resource for the world's economy. The U. S. Department of Energy says the world's winds theoretically could supply more than 15 times the planet's energy demand, or the equivalent of 5,800 quadrillion BTUs of energy each year. Currently, just a tiny fraction of that is being used.

[19] Reducing dependence on oil, coal, and nuclear plants by increasing production of wind energy will take time, but it can move much faster than it has been.

While the U. S. gets less than one percent of its energy from wind, a Federal research facility, Batelle Pacific Northwest Laboratory, says wind energy could supply about 20% of the nation's electricity, or 600,000,000,000 kilowatt hours annually. Other estimates are higher. For example, it is theoretically possible (with sufficient transmission and storage capacity) for North Dakota to produce enough wind-generated power to meet more than one-third of U. S. electricity demand.

[20] Wind energy does not generate greenhouse gases<sup>17</sup>, which is becoming a major reason for its growing importance. It is why Bush's Global Warming Initiative includes tax credits for renewable energy installations. The shift to wind has undeniable environmental and economic benefits. Moving away from fossil fuels to more wind energy would mean less acid rain produced by coal plants, far fewer greenhouse emissions from natural gas, less nuclear waste disposal issues, less depletion of remaining natural resources, and less drilling for oil and natural gas. In contrast, U. S. power plants emit 70% of the sulfur dioxide<sup>18</sup>, 34% of carbon dioxide, 33% of nitrogen oxide<sup>19</sup>, 28% of particulate matter, and 23% of toxic heavy metals into the environment, mostly the air.

[21] Dirty power is threatening the health not only of the planet, but the U. S. population. Harvard University medical researchers say burning fossil fuels is responsible for killing some 60,000 Americans each year and for worsening human health problems, especially respiratory and cardiovascular disease.

The American Lung Association says particulates from fossil fuel smoke-stacks are associated with the rapid growth in asthma among children and are especially concerning for people with chronic obstructive pulmonary disease, including emphysema and chronic bronchitis. Among the public costs of this pollution must be included all the increased emergency room visits and hospital admissions. The human costs of illness and disability cannot be calculated.

[22] It is hard to find a downside to replacing energy from fossil fuels with energy from wind. Until recently, that downside was economic. This no longer is the

case. Wind energy and other renewables such as solar energy and biomass are a benefit to the economy. They keep energy dollars local, provide jobs, and help offset the expense of cleanup and health care impacts that dirty power sources dump on society.

[23] This is not lost on Wall Street<sup>20</sup> or in the corporate offices of large energy investors. After steadily losing its share of large turbine manufacturing facilities to European interests, the U. S. wind energy industry received a boost in 2002 from the announcement that a division of General Electric was buying Enron Wind, keeping one of the largest turbine manufacturers in this country. Companies such as Chevron Texaco, BP Amoco, and Royal Dutch Shell are making significant investments in renewables. Clean Edge, an organization that tracks clean energy markets, has predicted that green energy will grow from \$7,000,000,000 in 2000 to more than \$82,000,000,000 in 2010.

[24] This is an industry that has been pioneered and paid for by people with a long-term vision for making the planet cleaner and healthier with clean energy. Now it is moving into the mainstream to be embraced by those who will favor clean energy so long as costs are at least close to equal. That is why Americans can expect to see rapidly increasing numbers of wind turbines in the future.

## Notes



1. David Blittersdorf: 大卫·布里特斯多夫(美国 NRG Systems 公司总裁兼首席执行官, 美国风能协会主席)
2. wind turbine: 风轮机
3. renewable energy: 再生性能源
4. kilowatt hour: [电] 千瓦(特)时; 一度(电)(能量单位; 略作 kWh 或 kw/hr)
5. fossil fuels: 矿物燃料
6. Instead of literally fighting for the last drop, it makes sense to shift to wind and other renewable energy sources: 为避免到时真的为争夺最后一滴燃油而拼命, 现在就应该明智地转而使用风能和其他再生性能源。
7. tax credits: 税款减免额(允许纳税人从其应纳税款总额中减除的款额); 课税扣除(指从应付税额中扣除按规定可用以抵税的款项; 如应付税额少于可用以抵税的款项, 则由税务部门付给差额, 作为补贴。)
8. depletion allowances: 折耗补贴(或优惠)(指公司所得税中, 允许可耗竭的油、气、矿藏资源的投资者, 可从其总收入中取得的扣除额。)
9. State of the Union address in January, 2002: 2002 年 1 月发表的国情咨文演说。

10. The perceived risks of living near traditional power plants contrast sharply with the unlikelihood of wind turbines becoming targets: 居住在传统发电站附近所感受到的威胁是显而易见的,而与之形成鲜明对比的是,风轮机不可能成为恐怖袭击的目标。
11. power grid: 高压电力网
12. A growing number of states have "net metering" laws that allow people producing their own wind energy to plug into the power grid serving their area and receive payment for the power they produce in the form of a credit against their electric bill: 越来越多的州开始实施“净用电量计量”法案,允许居民自行风能发电,并入为当地服务的高压电力网,并以抵扣电费的方式获取所提供电力的报酬。
13. solar panels: 太阳能电池板
14. black lung disease: (因长期吸入煤尘引起的)煤肺病,煤尘肺
15. fuel rods: (核反应堆中的)燃料棒
16. Gov.: 州长;总督(是 Governor 的缩写)
17. greenhouse gases: 温室气体(主要为二氧化碳)
18. sulfur dioxide: 二氧化硫
19. nitrogen oxide: 氧化氮
20. Wall Street: 华尔街(美国纽约市曼哈顿区南部的一条街道;是美国金融机构的集中地,现常作美国金融市场或金融界的代名词。)

## Vocabulary



- renewable /ri'njʊərəbl/ 1. a. 可更新的;能再生的 2. n. 再生性能源
- utility /ju:'tiləti/ n. 公用事业(公司) (= public utility)
- pioneer /,paɪə'niə/ v. 1. 促进(某事物的)初期发展 2. 开辟;倡导(新方法)
- ecosystem /i:kəusistəm/ n. 生态系统
- subsidy /'sʌbsɪdi/ n. (尤指政府为扶持工业、平抑物价等而发放的)津贴或补贴
- depletion /di'pli:ʃn/ n. 削减;消耗;耗尽
- portfolio /pɔ:t'fəuliəu/ n. 投资(组合)额
- surveillance /sə:'veɪləns/ n. 监视;监管
- benefits /'benəfɪts/ n. 津贴,救济金,抚恤金
- poll /pɔ:l/ n. 选举投票;民意测验
- vulnerability /vʌlnərə'biləti/ n. 易受伤害;易受攻击;无防御
- blade /bleɪd/ n. (螺旋桨等的)扁宽平面部分
- atop /ə'tɒp/ prep. 在……顶上
- resort /ri'zɔ:t/ n. 度假胜地
- awesome /'ɔ:səm/ a. 使人敬畏的;[俚]极好的
- visibility /vɪzə'biləti/ n. 可见度;可见性
- equivalent /i'kwɪvələnt/ n. 相等的事物或数量;对应词
- quadrillion /kwɔ'drɪliən/ n. 1. [美、法] 1 后有 15 个 0 的数 2. [英、德] 1 后有 24 个 0 的数
- initiative /i'niʃətɪv/ n. 为解决困难而采取的行动;倡议

- particulate /pə'tɪkjʊlət/ *n.* 微粒; 颗粒;  
 颗粒物  
 toxic /'tɒksɪk/ *a.* 有毒的  
 respiratory /rɪ'spaɪəətəri/ *a.* 呼吸的; 呼吸  
 用的  
 cardiovascular /ˌkɑːdɪəʊ'væskjələ/ *a.*  
 (病等) 心血管的  
 stack /stæk/ *n.* (尤指工厂的) 大烟囱;  
 (船上的) 烟卤  
 asthma /'æsmə/ *n.* 哮喘  
 chronic /'krɒnɪk/ *a.* (尤指疾病) 慢性的;  
 连续复发的  
 obstructive /əb'strʌktɪv/ *a.* 引起阻塞的  
 pulmonary /'pʌlmənəri/ *a.* 肺(部)的; 侵  
 袭肺部的  
 emphysema /,emfi'si:mə/ *n.* 肺气肿  
 bronchitis /brɒŋ'kaɪtɪs/ *n.* 支气管炎  
 downside /'daʊnsaɪd/ *n.* 缺点, 不利的一  
 面, 阴暗面  
 biomass /'baɪəʊmæs/ *n.* (尤指用作燃料来  
 源的) 生物质  
 embrace /ɪm'breɪs/ *v.* (欣然) 接受; 采取  
 black out (因供电问题引起的) 灯火熄灭  
 pull ahead 领先, 超越, 加速赶到前面

## Exercises



### Choose the best answer for each of the following.

- Which of the following is among the reasons for the author to advocate using wind energy?
  - Wind turbines are cheap to manufacture.
  - Wind turbines can stand any terrorist attacks.
  - Wind is readily available.
  - Wind power is easy to transform into other energy sources.
- Which of the following statements is true about the costs of wind energy?
  - The costs have been going down in the past few decades.
  - The costs have been going up since the 1970s.
  - The price has dropped to only four percent of the past.
  - The price is 90 cents per kilowatt hour now.
- What is the situation of wind energy application now in the U. S.?
  - As much as 40% of the energy needs in the U. S. is provided by wind each year.
  - Only 20% of the energy needs in the U. S. is provided by wind each year.
  - The U. S. is far ahead of Europe in terms of the percentage of energy needs provided by wind.
  - A much smaller percentage of the energy needs is provided by wind in the U. S. than in Europe.
- The author criticizes the U. S. energy policy in that \_\_\_\_\_.
  - heavy dependence on foreign energy sources creates instability in energy supply

- B. heavy dependence on foreign energy sources causes national security problems
- C. both importing oil and drilling oil in the U. S. lead to environmental and ecological problems
- D. all of the above.

5. What is the author's opinion towards the oil prices in the U. S. ?

- A. The prices are kept at a low level by government subsidies, tax credits and other supports from the government.
- B. The military actions in the Middle East will inevitably push up the prices.
- C. Drilling oil in the Arctic National Wildlife Refuge will help reduce the high oil prices.
- D. Government control over the prices will raise people's concerns about the stability of the nation's energy supplies.

6. President Bush's remarks in his State of the Union address are cited to \_\_\_\_\_.

- A. imply the government's decision to support wind energy application
- B. illustrate the potential dangers facing the traditional power plants
- C. support the author's criticism of America's heavy dependence on foreign energy
- D. explain how military actions will help maintain national security

7. How do local governments in the U. S. encourage people to use wind energy?

- A. People will be awarded a prize if they produce enough wind energy to power a local farm.
- B. People will have to independently provide for their own energy needs if they run small businesses.
- C. People are reminded of the dangers of living near traditional or nuclear power plants.
- D. People are entitled to payment from the government for the wind energy they produce for their area.

8. What is the attitude of the Vermont people towards wind energy?

- A. They support wind energy but are afraid of the natural beauty of their ski resorts being destroyed.
- B. They believe it is worthwhile to support wind energy even at the cost of a negative visual impact.
- C. They are proud of using wind energy and regard the wind turbines as part of the mountain scenery.
- D. They are not at all concerned with the visual impact of wind turbines on the mountain ridges.

9. According to the passage, burning fossil fuels is responsible for the increase in the incidence of \_\_\_\_\_.

- A. fire
- B. blood vessel diseases
- C. traffic accidents
- D. mental disorders

10. What can we learn from the last two paragraphs of the passage?

- A. The general public as well as people deeply concerned with the environment and health now welcome the idea of using wind energy.
- B. People deeply concerned with the environment and health advocate the wind energy but still find it hard to get public support.
- C. The majority of people in the U. S. understand the potential benefits of wind energy but still stick to fossil fuels for economic reasons.
- D. American companies are buying European turbine manufacturing facilities to satisfy the local needs.

**III. Guess the meaning of the underlined words or phrases from the context.**

1. With costs going down, interest in wind energy is moving beyond the core of "true believers" and going mainstream. (Para. 3)

- A. becoming the major source of energy
- B. being mixed up with the major rivers of the country
- C. starting to be accepted by the public
- D. getting government policy support

2. Trying to offset some of that dependence with more U. S. oil, such as that in the Arctic National Wildlife Refuge, risks destroying fragile ecosystems. (Para. 8)

- A. balance
- B. reduce
- C. enhance
- D. settle

3. Petroleum demand will outstrip supply in the first half of this century. (Para. 8)

- A. raise
- B. reduce
- C. pass
- D. ease

4. Americans' new concerns about dangers near home may also account for the recent rapid rise in "small wind". (Para. 12)

- A. explain the cause of
- B. result from
- C. give a reckoning of
- D. be considered for

5. The time it takes for people to recover their investments on these small wind units is decreasing as the technology is becoming less costly and electricity rates in general are going up. (Para. 12)

- A. return; speeds
- B. revive; proportions
- C. release; ranks
- D. regain; costs

6. In Vermont, for instance, Gov. Howard Dean and the state ski areas association have endorsed a plan to place wind turbines atop the developed mountains to provide energy for ski resorts. (Para. 17)

- A. written comments on the back of the document of
- B. written their names on the back of a check for
- C. approved and supported
- D. shown their disapproval of

7. Wind power is an inexhaustible energy resource for the world's economy. (Para. 18)

A. limitless      B. inexpensive      C. tiresome      D. recoverable

8. The U. S. Department of Energy says the world's winds theoretically could supply more than 15 times the planet's energy demand, or the equivalent of 5,800 quadrillion BTUs of energy each year. (Para. 18)

A. Battery Thermal Utilities      B. British Thermal Units  
C. Blackout Tracking Utilities      D. British Trade Unions

### Topics for discussion and reflection.

1. Why does the author say the dependence on foreign sources of energy may create national security problems?
2. Comment on the relationship between the situation in the Middle East and America's dependence on imported oil.
3. Do you have any suggestions for the future energy policy in China?

passage B

## *Back to the Future*

Peter Bunyard

- [ 1 ] One way to view the future is to obtain data from the distant past, for if we continue to burn fossil fuels and deforest at the current rate, within a century we might find ourselves with greenhouse gas concentrations in the atmosphere and surface temperatures similar to those of that ancient past.
- [ 2 ] Fifty million years ago, the planet had little ice, yet global temperatures were on average no more than 5°C warmer than today — slightly less than the upper bound<sup>1</sup> of temperature rise that the UN Intergovernmental Panel on Climate Change (IPCC) projects for 2100. Equally relevant, CO<sub>2</sub> levels in the atmosphere were probably no higher than the IPCC has projected as a strong possibility for 2100.
- [ 3 ] For those still unconvinced about the severity of the problems we would encounter if temperatures and CO<sub>2</sub> levels rise in this way, it is worth remembering that 50 million years ago sea-levels were several hundred feet higher than they are today. Most of that water is now ice in Antarctica and Greenland<sup>2</sup> — 6 meters of sea level equivalent is currently locked away in the Greenland ice sheet<sup>3</sup>, 6 meters in the relatively small and unstable West

- Antarctic ice sheet, and 60 meters in the huge East Antarctic ice sheet.
- [4] Were these ice sheets to melt, vast areas of the planet — including Denmark and large parts of eastern Britain and Holland — would vanish in their entirety<sup>4</sup>. It would be a world in which we would have considerable difficulty surviving, not least because of extreme weather conditions, which, combined with the loss of huge areas of cropland, would play havoc with food production.
- [5] But, given that we only have records of surface temperatures and precipitation pattern going back a few centuries at best, how can we know what the Earth's climate was like hundreds of thousands, if not millions of years ago?
- [6] That is where the Antarctic comes in, not only because of its 2,400-meter-thick cap of ice, which covers 14 million sq km, but also because of sediments off the land mass at Cape Roberts in the Ross Sea<sup>5</sup>. The ice, like that drilled at the Russian Base, Vostok, yields information going back 400,000 years on temperature, CO<sub>2</sub> content and sea level. One of the revelations about those 400 millennia from the analysis of gas bubbles in these ice cores is that throughout this period there is a strong association between temperature and CO<sub>2</sub> levels — they rise and fall together — confirming that the “greenhouse effect” of rising levels of heat-trapping gases causing temperatures to climb is not just theory.<sup>6</sup>
- [7] Analysis of Antarctic sediments allows us to look even further back into the past. The sediments overlying Beacon sandstone of the Devonian age<sup>7</sup> are only 1,500 m thick and date from 34 – 17 million years ago until the present. Drilling 100 m into the underlying sandstone, meanwhile, takes one back still further, to beyond 100 million years ago.
- [8] Peter Barrett, from New Zealand's Antarctic Research Center at Victoria University, has been part of a team of some 55 scientists from Australia, Britain, Germany, Italy, Netherlands, New Zealand and the U. S., who investigated the sediments. As he points out in *New Zealand Science Review*, these sediments are important because ice-core records can take you back only so far, and nothing in the ice-core history shows CO<sub>2</sub> levels in the atmosphere as high as we are likely to reach in a few decades. “Global climate, even in 50 years' time,” he says, “may be warmer than the Earth has experienced in the past 12 million years.”
- [9] From fossils in sediments, as revealed by tree stumps, leaves and coal seams<sup>8</sup> we know that 200 million years ago Antarctica was covered in forests and swamps. Antarctic temperature then was at least 15% warmer than today and, consistent with that, average global temperatures were some 7 – 8°C warmer than now.
- [10] Two distinct factors may have been responsible, then, for a warmer,



vegetation-covered Antarctica. During the Cretaceous and Early Cenozoic periods<sup>9</sup>, between 136 and 54 million years ago, we know that atmospheric levels of CO<sub>2</sub> were high, and certainly responsible for part of the warming. Also, at that time, Antarctica was still part of the supercontinent of Gondwanaland<sup>10</sup>. Once that continent began to break up, Antarctica became increasingly cut off by a strong polar air circulation system and consequently a cold circumpolar ocean current.

[11] As a result, the first ice-sheets formed over Antarctica 34 million years ago, and then, as the Earth cooled still more, some 2.5 million years ago, the ice-sheet formed for the first time over Greenland in the northern hemisphere. From then on, we have had ice ages affecting both poles.

[12] Since the Arctic has never been as isolated as Antarctica, greenhouse gas concentration was probably a critical factor in its impact on surface temperature. An additional factor was the degree to which the warm waters of the Gulf Stream<sup>11</sup> penetrated into the Arctic Circle<sup>12</sup>. At the other pole, in all probability, the cold circumpolar current contributed most to the chilling of Antarctica, in which case it might take more than elevated CO<sub>2</sub> levels to bring about a complete melting of the Antarctic ice-sheet.<sup>13</sup>

[13] Yet, as the ice-core data shows, the expansion and retreat of the ice-sheet during the glacial and inter-glacial periods have always been associated with swings in temperature that themselves correlate closely with levels of CO<sub>2</sub> in the atmosphere, and changes in sea-level. Some 18,000 years ago, when the last ice age was at its most intense, CO<sub>2</sub> levels were 30 per cent below 1900 levels and sea-level was 120 m below present sea-level. That should warn us that whatever regulates greenhouse gas concentrations in the atmosphere could have profound effects on climate.

[14] In fact, we do not know which triggered which in the past: whether higher CO<sub>2</sub> concentrations in the atmosphere triggered temperature rise or whether temperature rise triggered higher CO<sub>2</sub> concentrations. In all likelihood, one affected the other. But we do know that the initial cause of changes in temperature and greenhouse gas concentrations in the past was almost certainly the changing obliquity and eccentricity of the Earth's orbit and the movement of the Earth from side to side (known as the Milankovitch Wobble) which together determine changes in the pattern of solar energy reaching the Earth.

[15] The Antarctica data are the best record we have showing correspondence between the retreat and then re-establishment of the ice sheet in relation to the Earth's orbit around the sun. Until 800,000 years ago, the glacial cycle lasted some 40,000 years, but then lengthened into the current 100,000 cycle.<sup>14</sup> The