

Table of Contents

WIND POWER: HARNESSING NATURE

Introduction	43
The Answer's in the Wind	44
More Energy, New Sources	45
International Precedents	49
The Canadian 10 X 10 Plan	51
A Local Approach	53
Discussion, Research, and Essay Questions	55

WIND POWER: HARNESSING NATURE

Introduction

In one of the most memorable scenes in Miguel de Cervantes 17th-century novel *Don Quixote*, the Don, his mind addled by a life spent reading romances, rides his horse across the Spanish plain and encounters a group of 30 to 40 windmills. In his confused condition, he mistakes these for giants, and drives his lance into the sail of the nearest one. Both the knight and his steed are lifted into the air and thrown to the ground, much injured by the power of the wind.

Were the Don to encounter a modern wind turbine he would certainly recognize it as a giant. Picture, for example, the windmill installed at the nuclear generating station in Pickering, Ontario. This giant consists of a 78-metre steel tower topped by a generating unit about the size of a bus, with three rotating blades each 39 metres long. A giant, but not a monster: the blades rotate a sedate 15.7 revolutions per minute, and the turbine produces 1.8 megawatts of electricity. It is the largest and most powerful wind turbine installed in North America. The Don, whose “impossible dream” is the attainment of lofty goals and ideals, might not recognize the windmill, but he would understand the concept it represented: a constant, reliable, natural source of energy being exploited in the service of human beings.

Wind power has assumed a prominent role in many countries over the last 30 years. The rising cost of fossil fuels like oil and natural gas, combined with concerns about their availability, led to renewed interest in renewable sources of energy in the 1970s, and also led to the first modern use of wind power to generate significant amounts of electricity. Worldwide concern about greenhouse gas

emissions—a significant byproduct of fossil fuel use—and health concerns over increasing amounts of smog have kept interest high in discovering new sources of pollution-free energy. These sources are needed to generate both the energy the industrialized countries have come to depend on, and the energy developing countries require to improve their standard of living.

Wind power is seen as a major player in renewable energy development because its technology has improved dramatically over a short period of time and has proven itself to be safe, clean and reliable. Countries such as Spain, Germany and Denmark have made it the cornerstone of their new energy programs. As well, the United States, especially in California, has developed significant wind farms to supplement its energy supply from fossil fuel sources.

Until recently, Canada has had few actual wind power installations. However, major new installations in Quebec and Alberta, both publicly and privately owned, have shown promise that wind power could be an important part of Canada’s total energy production system. Other provinces, including Ontario, Newfoundland, and Prince Edward Island, have begun (or are studying) demonstration projects. New methods, such as wind co-operatives, are being initiated to help bring more projects online. Many experts, including those at Pacific Gas & Electric and the Electric Power Research Institute, have predicted that wind will ultimately become the least expensive electricity source. The rapid decline in the cost of wind-generated electricity indicates that they may well be correct.

WIND POWER: HARNESSING NATURE

► *The Answer's in the Wind*

Until very recently, Canada's electrical capacity has been generated by traditional sources of energy: those that easily generated large quantities of energy at low cost to consumers. While these still remain the norm, the negative environmental effects of using primarily fossil fuel energy sources has led to increased interest by both private and public sectors in discovering or developing new, clean forms of energy. Wind power, actually one of the oldest forms of energy used in small-scale applications, is one of the most promising of the new large-scale alternatives.

Wind Power in Context

Before viewing this *News in Review* report, discuss in small groups your understanding of the following terms, and arrive at a group definition. Brainstorm appropriate examples for each.

- energy resources
- alternate energy resources
- renewable energy resources
- fossil fuels
- greenhouse gases
- smog
- windmill

Now, as you watch the video, make point-form notes that help you answer the following questions:

1. What factors—environmental and international—have made it important for Canada to find new ways to generate electricity?
2. What was the commitment Canada made when it signed the Kyoto agreement on greenhouse gases? By how much will Canada actually have to cut its greenhouse gas emissions by 2010 in order to meet its commitment?
3. Why has large-scale wind power become one of the most promising new forms of energy?
4. Why has Canada been slower than much of the rest of the industrialized world in embracing wind power as a new source of energy?
5. How do the current costs of generating electricity using the wind compare with costs in 10 or fewer years?

Post-Viewing Activity

1. In your original groups, review your definitions and decide if, after watching the video, you should modify or expand them.
2. In the video Marni Kagan says that, when it comes to wind power, “What Canada needs to compete with the other countries is government support.” What forms might that support take? If the cost of wind power drops, will government support continue to be necessary to promote a Canadian wind power industry?

WIND POWER: HARNESSING NATURE

► *More Energy, New Sources*

Wind power is now the fastest-growing source of electricity both in Canada and in the world. Worldwide, wind power has a growth rate of approximately 30 per cent, and currently provides enough power for over 20 million people.

It is important to remember that wind-powered ships made a global shipping industry possible for thousands of years. And windmills have commonly been used to do work such as grinding grain and pumping water. We know that the Persians used a horizontal windmill in the 10th century, and may even have developed it three centuries earlier. By the end of the 12th century those windmills we usually think of as being “Dutch”—with huge sails to catch the wind—were being used throughout all of northern Europe. By the 14th century they had reached Spain and southern Europe; ultimately they came with settlers to almost all parts of North America. In North America, windmills remained a common part of the rural landscape—at one point there were about 150 windmill manufacturers in the United States—until after the Second World War, when rural electrification really took hold in both Canada and the United States.

Wind Power Rediscovered

The oil supply crises in 1973 and 1979 led to renewed interest in wind power, and a first commercial market for electricity generated by windmills appeared in California during the first half of the 1980s. Almost 15 000 wind turbines generating from 55 kilowatts (kW) to 100 kW were installed during this period.

An increase in the supply of oil and a decrease in its price led to the collapse of the California wind power market and a shift in leadership in wind power technology to Europe. In particular, the Danes modified their standard three-bladed upwind design and by 1990 had produced a machine with an output of 250 kW. This not only produced more power, but also made the turbines more cost-effective.

Since 1990, wind turbines have become dramatically larger and more powerful. Medium-size machines, the most commonly used in Canada, each generate about 600 kW. The giant demonstration turbine installed by Ontario Power Generation at its Pickering nuclear plant is a Danish-built model with a capacity of 1.8 megawatts (MW). This is, for now, the largest wind turbine in North America, capable of supplying enough power to serve 600 households a year. In the last 10 years, wind turbines have also proven themselves to be especially reliable and low-maintenance sources of electric power.

As windmills have increased in size, the cost of the electricity produced by them, measured in kilowatt hours (kWh), has declined. The cost in many parts of the world—especially in those countries that encourage the use of alternate (i.e. renewable, non-fossil fuel) energy sources—is now competitive with traditional sources of power.

As Bruce Bailey, the president of AWS Scientific (an engineering and meteorological consulting firm in the U.S.) stated, “Wind has no energy costs, and no energy cost risks. Essentially

all the costs are up-front with the installation.” In other words, people relying on energy from wind power need not worry about fluctuating (usually rising) costs in the fossil fuel market. The fuel itself is free. And Bailey adds, “There are no emissions, either, no contributions to global warming, no acid rain. Those all have intrinsic values.”

A Need for Renewable Energy Sources

In countries like Canada (which currently obtains over 36 per cent of its electricity from nuclear energy or fossil fuels) and the United States (which obtains about half of its electricity from coal-fired plants and another 20 per cent from nuclear energy) any possibility of reducing emissions that cause smog and greenhouse gases is of great interest. Experts estimate that wind power could easily supply 10-20 per cent of the world’s energy needs, eliminating the annual emission of about three million tonnes of carbon dioxide alone into the atmosphere.

The International Energy Agency has predicted that the worldwide demand for energy will increase by 57 per cent over the next 20 years. The Pew Center of Global Climate Change predicts that developing countries alone will invest at least \$1.7-billion (US) in new electric generating capacity by 2015. At this rate, oil will be consumed at a rate of 115 million barrels per day, up from the current 76 million. Carbon dioxide emissions will rise by 60 per cent, and one-third of these emissions will be the result of the generation of electricity.

Canada and the United States, however, continue to look at the development of new sources of fossil fuels as the prime sources of future electric power. In a heavily criticized move, the current U.S. government hopes to open up the Arctic Wildlife Refuge to oil exploration. The Canadian and Alberta governments point to the huge (and expensive to exploit) Alberta Tar Sands as a great future source of oil—the “Saudi Arabia of North America.” And fossil fuel use is still heavily subsidized in many parts of the world, through price supports, tax breaks and financial aid to industry.

Outside North America, however, renewable energy is seen as both an industrial and government priority. Especially in Europe and Japan governments subsidize the development of renewable energy technology, and European and Japanese companies are now the biggest players in this field. These companies (like the Danish firm Vesta Wind Systems, which built the Pickering turbine) now supply not only North America with most of its new windmills but also the rapidly growing markets of developing countries like China and India. The U.S. Intergovernmental Panel on Climate Change recognizes that the best way to fight climate change is to emphasize the new technologies that make conservation easier and more economical, and even profitable. Major oil companies like Shell have recognized the economic viability of renewable energy technology and have begun to make significant investments. Shell is particularly bullish, predicting that by 2050 more than 50 per cent of the world’s primary energy supply will come from renewable sources.

Farming the Wind

There are several sources of renewable energy currently available. The most significant and commonly used worldwide is hydro-electric (the generation of electricity by water power), which currently meets about 61 per cent of Canada’s needs. Other sources include solar (derived from the sun’s radiation), biomass (burning organic wastes], and tidal power (kinetic

energy created by the ebb and flow of large bodies of water). But the fastest-growing source in both Canada and the rest of the world is wind power, and there are several reasons for this.

- The first of these is the rapid development of the technology allowing turbines to produce significant amounts of electricity. In less than 25 years, industrial windmills have grown from machines with blades five metres long, generating 30 kilowatts (or less), to turbines with 39-metre blades capable of producing almost two megawatts (MW).
- Size has not been the only technological improvement. Newer windmills are now self-monitoring, and adjust their direction and blade angle to make the most of the wind's natural power. New turbines are able to generate steady streams of power no matter what the wind speed, and are designed to work in areas with an average annual wind speed of about 20 kilometres per hour. Rotor speed has slowed, meaning less noise and fewer birds sucked into the machinery (the two biggest objections to wind turbine installations from environmentalists).
- Wind turbines have another major advantage over other energy producers in that they can be built and put into operation very rapidly. Traditional power plants fuelled by natural gas, producing 550 000 to 700 000 MW, take about two years to construct. A wind farm with turbines producing one million MW could be online in six months to one year.
- Because wind turbines are non-polluting, the environmental approval process from all levels of government tends to be much quicker than that for fossil fuel plants. Government environmental impact studies on wind power installations are accomplished very quickly. Large wind farms are usually constructed in sparsely settled areas or off-shore from settled areas, reducing the number of complaints of both visual and noise pollution. Large wind complexes do take up vast amounts of land, and some experts are concerned about public rights and property rights. However, in areas where turbines are grouped together in large farms, especially in the western parts of Canada and the mid-western United States, landowners are usually more than happy to accommodate them. For example, the same area of land that produces \$50 worth of wheat can be leased to electricity providers who pay at least \$2000 a year per turbine. Farmers who have leased land for wind farms generally indicate that the presence of the turbines has little to no effect on their day-to-day operations.

Wind power is not without its critics, however. The installations do produce some noise, even though this has become much less significant in recent years. They can cause some types of signal interference. Early windmills were notorious "bird shredders." They still kill some birds; however much of this problem has been solved by slower rotors and careful location of the turbines away from flight paths. Offshore wind farms may affect fish and shellfish—and even the navigation of porpoises—and the effect of existing offshore installations is being studied.

Despite the criticisms, wind power is the current darling of the renewable energy industry, and seems poised worldwide to catch an increasing segment of the entire energy market. Even in

North America, with an economy heavily dependent on fossil fuels, wind power installations are in the planning stage or are actually being built at an impressive pace.

Discussion

1. What should the Canadian government's role be in the development of renewable energy resources? For example, should it assume a leadership role, identifying the most valuable ones and providing funding to ensure their development by Crown corporations? Or should it rely on the private energy industry to choose and develop those resources most appropriate to Canada's needs? How should governments monitor or regulate this industry?
2. Some analysts argue that factoring health costs into the energy equation results in a significant reduction in what they consider the real cost of developing renewable, non-polluting technologies. In your opinion, how should we balance, integrate, or reconcile long-term health costs and energy costs? Should they appear on the same social balance sheet?

WIND POWER: HARNESSING NATURE

International Precedents

In terms of the development of sustainable energy resources, why is it important for us to understand what is happening outside Canada, especially in high-energy-using nations such as the United States? Bear this question in mind as you read the following information.

What critics call an insufficient emphasis on wind power and other renewable energy sources in Canada does not reflect what has been happening in other parts of the world, especially in Europe. Since 1990, the countries of the European Union have increased their non-hydro-electric renewable power capacity by 200 per cent, 10 times the North American rate. Iceland and Norway obtain almost all their electricity from renewable sources, and other countries are working hard to catch up.

The fastest-growing renewable source is now wind power, and the country producing the greatest amount of electricity using the wind is Germany. Traditionally, Germany has been totally dependent on fossil and nuclear fuels. Because it intends to withdraw completely from nuclear energy, it has aggressively developed its wind turbine capacity, and now produces 6000 MW (megawatts) by wind power alone. (Canada, in comparison, produces 140 MW.) Germany has some of the largest windmill manufacturers in the world, and exports to many countries. It also works with other governments to develop new areas for exploitation. Germany is currently working with Argentina to install windmills in Patagonia, one of the windiest regions of the world. Once the installations become part of the Argentine power grid they could conceivably deliver a major part of the electricity used by the entire country.

Several other countries are also committed to developing their wind resources. Since 1997, the fastest-growing wind market has been Spain, which now has almost as much wind power capacity as the United States. In Britain, the British Wind Energy Association is expecting a huge increase in the number of offshore wind farms. Swedish designers have developed a gearless windmill with the potential to revolutionize the market. Other countries, such as the Netherlands, have been committed users of wind power for many years.

Denmark

But it is Denmark that is the model of development for wind power enthusiasts everywhere. Denmark currently produces 15 per cent of its electricity with wind turbines, and expects to produce 50 per cent by 2030. Over the last 10 years, Denmark has reduced its greenhouse gas emissions by 21 per cent, largely on the strength of its increased use of windmills.

Denmark is also the world's leading exporter of windmills. The two largest manufacturers of wind turbines are Danish. The largest and most famous is Vestas Wind Systems, manufacturer of the new Pickering turbine. Half the windmills currently in use around the world are Danish-built, and the industry employs over 12 000 workers. Denmark's special role was recognized when international members of the wind power industry came together in Copenhagen in July 2001 to set up the World Wind Energy Association.

The United States

The U.S. currently obtains 92 per cent of its energy from fossil fuels and nuclear power, and less than one per cent from solar, wind, or geothermal sources. Most experts estimate that the percentage of energy produced in the U.S. from renewable sources will increase to between three and six per cent by 2020. (The U.S. has about five per cent of the world's population, but uses 25 per cent of the energy the world produces.) It is also expected that most of this renewable energy will be produced by wind power.

For many years California has led the U.S. in wind power development. The San Geronio Pass near Palm Springs has long been recognized as an exceptional natural wind tunnel, and nearly 3000 windmills have been erected there, providing a combined output of about 1.5 per cent of California's total electricity consumption. However, all areas of the country, with the exception of the southeast, have areas of high wind that could be exploited. Mark Jacobson of Stanford University feels that it would even be realistic for half of the U.S. energy needs to be met by wind power, especially if the area sometimes described as the "Saudi Arabia of wind" (eastern Montana and the Dakotas through to Nebraska, Kansas, and parts of Texas) was fully utilized. He envisions 370 000 turbines costing about \$1.5-million each being built in incremental steps of five per cent every three to seven years. Ultimately, these turbines could eliminate 59 per cent of the country's coal-generated electricity.

Significant projects are in the development stage in the U.S. The largest of these is the Stateline Wind Project, also known as the Walla Walla Wind Farm, being constructed on the border between Washington and Oregon. The project will use 450 Danish-built windmills generating up to 718 MW to provide power to at least 75 000 families. The project was designed when electricity from natural gas was as high as 15 cents per kilowatt hour (kWh); the cost for wind-produced electricity is expected to be less than three cents per kWh. Other projects are underway in Texas, Montana, Minnesota, Kansas and Nevada; and some states such as Colorado have seen their regulatory agencies demand that electricity providers add wind power to their energy portfolios. While major energy corporations such as Florida Power and Light see natural gas as the energy source behind much of the U.S. future power generation, it seems clear that wind power also has a major role to play.

Discussion

To what extent might the perception of wind power be that of a "foreign" technology more appropriate to geographically smaller and more densely populated countries? Why might such a perception develop? What is the fallacy of such a perception? How might it have an impact on the adoption in North America of wind power as a viable energy resource?

WIND POWER: HARNESSING NATURE

► *The Canadian 10 X 10 Plan*

Any important and far-reaching endeavour requires careful planning and a clear timeline. As you read the following information, consider whether 10 years is a long or a short period of time in terms of issues related to energy production.

In June 2001 the Canadian Wind Energy Association (CanWEA), an association made up of government, industry, corporate, and private members, released its report *Wind Vision for Canada*, recommending that Canada's wind capacity grow to at least 10 000 megawatts (MW) by the year 2010 (hence the 10 X 10 formula). The authors note that world wind power capacity grew by 32 per cent in 2000. During the same period, Canada's rated capacity grew from 127 MW to 140 MW, or about 10 per cent. The Association feels that it is imperative that Canada ensure that new measures encourage the growth of wind energy. In the association's view, such measures will be creating "thousands of jobs, limiting emission of greenhouse gases (GHG) and other pollutants, reducing health costs and securing an abundant and secure source of green power."

The report notes that both the European Union and the United States are making significant investments in wind power, and that Canadian companies are beginning to follow suit, despite a "much less attractive investment climate than in other countries." It also notes that Canada's wind energy resources are among the world's best; that, as energy costs rise, wind has a very stable cost not subject to large increases; and that electricity from wind energy can be brought online within a very short timeframe.

It lists the benefits of the 10 X 10 program as follows:

- \$10- to \$20-billion of economic activity for Canadians
- 80 000 to 160 000 high-quality jobs
- Contribution to clean air and human health benefits
- Reductions of 15 to 25 million tonnes of greenhouse gas emissions per year
- 30 million megawatt-hours per year of renewable energy at a stable price

The report argues that in order for Canadians to meet the goals of the program, significant changes will need to be made in government support for renewable resource development. Chief among these will be federal revenue incentives and tax credits, support for research and development, and a commitment by all levels of government to buy as much "green" power as possible to meet their needs.

According to Statistics Canada, in 1999 Canada's electricity came from the following sources: hydro, 61 per cent; coal, 18 per cent; nuclear, 12 per cent; natural gas, 12 per cent; diesel and oil, two per cent; biomass, one per cent; wind, tidal, other fuels, 0.4 per cent.

Canadian Precedents

It might surprise many Canadians to learn that Quebec, a leading producer of hydro-electric power, is currently the largest producer of wind power in the country. The *Le Nordais* project

is located in the Gaspé, and has 133 750 kW (kilowatt) turbines producing 100 MW of electricity. The province hopes to add another 450 MW over the next nine years at a rate of about 50 MW per year.

- Alberta has also seen significant investments in wind power facilities. Cowley Ridge is home to one large installation, an 18.9 MW wind farm that provides enough electricity to supply about 6800 homes. An Alberta company, Vision Quest Windelectric Inc., recently signed a contract with the city of Calgary to provide power from windmills to run the city's light rapid transit (LRT) C-train, and is adding 10 new towers to fulfill the contract. The Ride the Wind program, as it is called, will reduce the city's greenhouse gas emissions by about 21 000 tonnes per year. Vision Quest owns more than 20 wind turbine power plants in Alberta. Working with TransAlta Corp, one of Canada's largest power companies, Vision Quest hopes to have at least 60 turbines operating in southwestern Alberta, each rated at 660 kW. TransAlta hopes to ensure that 10 per cent of all its new power comes from wind or other renewable resources.
- Ontario Power Generation (OPG) has experimented with a 600 kW turbine at Tiverton since 1995. The success of the Tiverton experiment led to the installation of the 30-storey, 1.8 MW Vestas turbine in Pickering. The latter unit is a demonstration unit, installed to determine how a large-scale turbine works in Ontario's specific wind and weather conditions. Pickering was chosen because of the steady winds near Lake Ontario and its direct plug-in to the existing Ontario power grid. OPG also plans to join with British Energy (Canada) Ltd. to develop Ontario's first wind farm, the Huron Wind Project, near the Bruce Nuclear Generating Station. The farm will produce 10 MW, and the 10 turbines will cost about \$15-million to put into operation.
- Newfoundland has also announced plans to study the use of wind power in meeting its electrical power needs. The success of a project at a demonstration site would mean a likely go-ahead to develop a wind farm with a capacity between five and 25 MW. Hydro and geothermal power supply most of the province's needs, but winter conditions currently require supplementing them using a 490 MW heavy-oil-fired generator.

Although these projects demonstrate a real interest in Canada in taking advantage of this clean, renewable source of power, wind remains, at present, only a tiny part of the total Canadian energy package.

Discussion

Electricity from wind power is currently slightly more expensive to produce in Canada than electricity from traditional sources. Given the option, how likely are Canadians to choose to pay a somewhat higher electric bill to support a cleaner, renewable resource? Would it be more or less publicly acceptable if the difference were made up through government supports and tax incentives?

WIND POWER: HARNESSING NATURE

➤ *A Local Approach*

Toronto experiences some of the most heavily polluted air in Canada. In summer, smog alerts are common and citizens are advised to take precautionary measures for health reasons. Much of the energy used to provide the city's electricity comes from coal, and this contributes significantly to the city's poor air quality. Health experts estimate that every year well over a thousand people die in Toronto and Southern Ontario as the result of diseases related to air pollution.

One Toronto group has decided to take action. The Toronto Renewable Energy Co-operative (TREC) has formed a Windpower Co-operative (WPC) to bring windmills to Lake Ontario for the production of electricity. A wind power project was selected by TREC for a variety of reasons, including the proven reliability of wind turbines and their freedom from emissions. TREC estimates that the turbines it constructs on Toronto's waterfront will reduce the sulphur and nitrous oxides that would otherwise be produced by coal-fired plants.

WPC plans to build as many as three wind turbines producing 660 kilowatts of power, enough to power at least 250 average-sized homes. The turbines will be built in conjunction with Toronto Hydro Energy Services. Membership in the co-operative "is open to any individuals, institutions, or corporations who are Toronto Hydro subscribers." Membership requires a purchase of at least one turbine unit of ownership. (The Co-op hopes to sell 2000 units at \$500 each.) All members/shareholders have one vote in the co-operative, and are entitled to a portion of the green power produced by the windmill. The windmill will be connected to the Toronto grid, and members will be credited with a savings on their bill from Toronto Hydro. TREC expects more than 2000 individuals and groups will subscribe to the co-op.

TREC chose the co-operative approach to green energy production for very specific reasons. Their stated rationale includes the following:

"The WPC offers a unique opportunity to Torontonians to become part of the solution in the fight against climate change and smog. Their investment will be a highly visible symbol of what can be done by local groups to fight climate change, and will help inspire the growth of renewable energy and other community-based projects such as WPC. . . . Members will know that their investment in the WPC will have an ongoing positive effect on the environment through reduced reliance on nuclear and coal-generated power. They will also be directly addressing problems associated with poor urban air quality and global climate change through reductions in CO₂ and other greenhouse gases, smog precursors, toxic compounds and heavy metals emissions."

WPC has received all of the necessary government approvals and is proceeding with the project.

Discussion

1. The TREC focuses attention on the environmental damage caused by fossil fuels and emphasizes our ability to minimize the use of them. In your opinion, how will

the public react to TREC's proposal? What is the organization offering consumers? What would motivate Torontonians to become part of the co-operative? For what reasons might they not become involved?

2. If TREC succeeds in building all three of its planned turbines, they will provide sufficient power for 750-1000 households in a city of 2.2 million people. How effective a demonstration will this be of the value of green power in meeting Canada's energy needs?

Perspective

The Windpower Co-operative project is not by any means a new concept, although it will be a first for Canada. The Danes, world leaders in wind power technology, are also avid believers in co-operatives. Three quarters of Danish wind power capacity is privately owned; and half of this private ownership is by wind energy co-operatives. One of the most impressive of these co-operatives is the Middelgrunden Wind Turbine Co-operative, which has installed 20 two-megawatt turbines just two kilometres from Copenhagen, the Danish capital.

While many times larger than the Toronto effort, Middelgrunden shares many of the goals of WPC. The co-operative is especially keen on public promotion of sustainable energy. By placing the turbines close to Denmark's largest city it visibly makes the point that the public can be influential in determining the sources of its energy. Like the WPC project, Middelgrunden is a collaboration between the public power utility and private investors, a combination that in Denmark has been found "to result in better and less costly projects than the wind turbine projects carried out by the public power utilities alone." As well, the Middelgrunden project promotes itself as both financially and environmentally sound for its investors: "It is important that renewable energy is made economically sound and thus attractive for potential shareholders. In this way the possibilities of using wind power are increased."

Discussion

Why might co-operation between the public and private energy sectors result in "better and less costly projects" than those developed solely by public utilities?

For more information on the WPC project, access its Web site at www.trec.on.ca. Information on the Middelgrunden Wind Turbine Co-operative can be found at www.middelgrunden.dk/MG_UK/ukindex.htm.

WIND POWER: HARNESSING NATURE

Discussion, Research, and Essay Questions

- 1. While the fastest-growing renewable energy technology, wind power is not the only one currently being developed in Canada. Other sources include solar power, geothermal energy, biomass energy, and tidal power. Research one of these alternative energy sources and prepare a short report describing what it is and how it might be used.
- 2. Do you know the specific energy sources used to provide electricity for the part of Canada in which you live? Contact your local electricity provider and determine the main types of power plants supplying your area. Determine if any renewable resources are being used by the utility, or if there are plans to include them in the future. Report back to the class with the results of your research. You may also wish to invite a representative to speak to your class.
- 3. Some provinces have either deregulated the electricity suppliers industry or are planning to do so, making it possible for customers to choose their supplier and the source of the power they purchase. In theory, this should make it easier for interested citizens to promote the construction of renewable resource power plants like wind farms. If “green” power becomes a viable consumer choice but is more expensive than energy from fossil fuels, will consumers be willing to pay the extra amount?
- 4. The renewable energy industry emphasizes the need for government involvement in promoting alternative energy sources. Suggest specific provincial/territorial or municipal government policies that could encourage the development of new energy resources.
- 5. Energy co-operatives have proven to be effective in promoting the use of renewable energy technologies in Europe where fossil fuels are relatively expensive. Will they prove as effective in Canada, where oil, coal and natural gas are relatively abundant in supply and also relatively cheap? Define the role public motivation plays in the development of renewable energy sources.
- 6. Energy co-operatives have proven to be effective in promoting the use of renewable energy technologies in Europe where fossil fuels are relatively expensive. Will they prove as effective in Canada, where oil, coal and natural gas are relatively abundant in supply and also relatively cheap? Is this abundance of fossil fuels likely to affect the approach co-operatives use in promoting their missions?
- 7. In this *News in Review* report, it is suggested that renewable energy may have a “crunchy granola” image, which can make it difficult to find serious investors for such projects. In your opinion, what is the public image of “green power” energy? Does this issue reflect a generational or cultural gap?