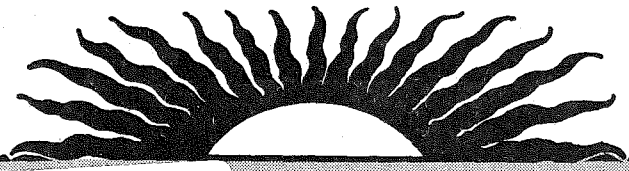
THE ENERGY BOOKLET

A CRITICAL LOOK AT NUCLEAR POWER IN ONTARIO AND A GUIDE TO A NON-NUCLEAR FUTURE BASED ON CONSERVATION AND RENEWABLE ENERGY.



y the Birch Bark Alliance
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ABOUT THIS BOOKLET

THE ENERGY BOOKLET is designed to provide students and citizens with a brief, readable introduction to one side of the energy debate in Ontario. The booklet offers a direct challenge to Ontario's commitment to continued reliance on non-renewable energy sources — particularly nuclear power — and points towards the alternatives, including serious conservation measures and the development of renewable energy sources.

Although nuclear now supplies only five per cent of Ontario's energy consumption, we have devoted half of the booklet to a discussion of its defects. This is because nuclear continues to receive the lion's share of funds devoted to energy research and development in Ontario, and because the current government of Ontario has made very clear its commitment to an expanded role for nuclear-generated electricity in the province's energy future.

We believe that nuclear power is neither necessary nor desirable, and that it poses environmental, economic, and social threats. We also believe that government policies designed to support the continuing emphasis on this and other large-scale, centralized energy technologies impede progress toward a safe, sane energy future based on conservation and renewables.

Nothing in this booklet is original. Its contents have been assembled from the work of dozens of people, particularly the contributors to the Birch Bark Alliance (a quarterly "voice of nuclear concern"), and the Energy Probe crew. Jan Marmorek's 'Over a Barrel', and the CANDU? monograph by Glen Wood and Donald Blair also proved very useful.

Responsibility for errors and omissions remain with the author.

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Clifford Maynes

September, 1981

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PART I: THE CASE AGAINST NUCLEAR

OVERVIEW

The nuclear dream has lost its shine

ONTARIO'S ROMANCE with nuclear power began in the 1960s, when electrical demand was still growing by six or seven per cent a year — a doubling each decade — and when planners assumed that these rapid growth rates would continue.

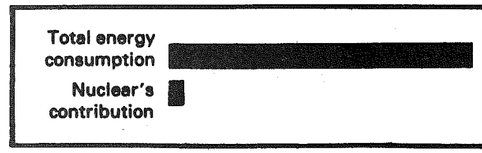
At the time, Ontario Hydro still relied almost exclusively on water power. But the utility calculated that the remaining undeveloped water power in the province could not meet the anticipated long term demand. Hydro needed a new energy source to satisfy its power-hungry customers.

The answer was thermal generating stations — electrical plants which used steam rather than falling water to turn their turbines. To create this steam, Hydro would use oil, gas, coal, and above all, uranium. Nuclear power would harness the intense heat generated by the splitting of the atom, thus finding a peaceful use for the terrible force displayed to the world in the form of the atomic bomb.

Hydro's engineers became intoxicated by the fabulous potential of their new technology. They believed that nuclear would be cheap, clean and safe — the key to a new tomorrow. And they planned to sprinkle the Ontario countryside with dozens of nuclear reactors.

SINCE THEN, the shine has come off the nuclear dream.

The public has become deeply disturbed by the environmental and safety issues surrounding nuclear power. The Three Mile Island accident and other incidents have stoked fears about the safety of reactors. But there are also growing fears about the safety of the rest of the nuclear fuel chain, from mining and mine tailings, to refining and refinery wastes, to spent reactor fuel and its transport and disposal.



See back page for chart and map detailing Ontario's nuclear programme.

The nuclear power industry has also come under attack for its links with nuclear arms and the threat of arms proliferation.

Meanwhile, nuclear has proven to be enormously expensive, making a mockery of the claim of one American official that it would provide power "too cheap to meter".

Although billions of dollars and a great deal of fanfare have been devoted to Ontario's ten operating nuclear reactors (Rolphton, Douglas Point, and four reactors apiece at Bruce and Pickering), their combined output provides a mere five per cent of Ontario's total energy consumption.

Nuclear's contribution to the total annual electrical output seems more impressive—it is almost a third. But Ontario Hydro has far more generating capacity than it needs (as much as 45 per cent surplus in recent years. The normal reserve margin is 25 per cent). Thus the role of nuclear, even in electricity production, is not so significant as we have been led to believe.

In fact, the evidence shows that we could live entirely without nuclear power. Ontario's growth rate in electrical demand has toppled in recent years—we won't need the power we thought we would need. And simple, cost-effective conservation measures could reduce that demand even further.

Furthermore, there are better ways than nuclear to produce the electricity we *do* need. And there are more appropriate alternative energy sources to replace our dependency on oil.

TODAY, NUCLEAR POWER in Ontario is embattled as never before. Part I of this booklet, the Case Against Nuclear Power, focusses on the defects of Nuclear. Part II, The Safe Energy Future, is much more positive. It points the way towards an energy economy which abandons nuclear in favour of safe, sane, alternatives, and it invites us to make the choice which is open to us. ■

"... the nuclear option, far from guaranteeing energy self-reliance, at best promises uncertainty."

Arthur Porter, chairman Royal Commission on Electric Power Planning.

The dangers cannot be denied

THE WORST POSSIBLE nuclear reactor accident is a meltdown. If the coolant surrounding the reactor core leaked out, or if the flow of coolant became blocked, and if the back-up safety systems failed, the chain reactions in the core would surge out of control and heat to supernormal temperatures.

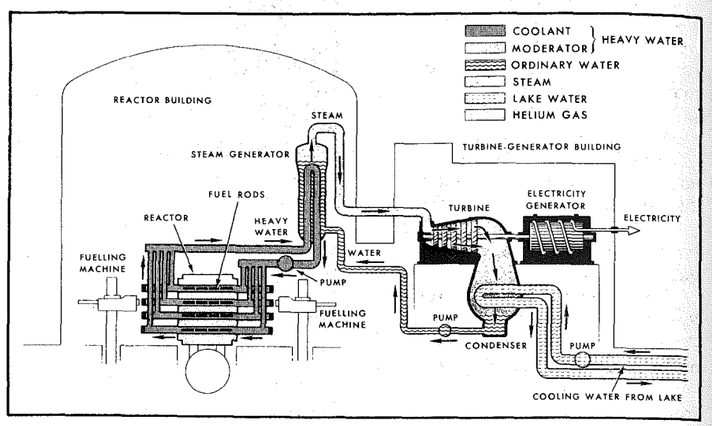
The core would become so hot that the fuel bundles would fuse together, melt through the floor of the reactor building and sink straight towards China—which is why a meltdown is sometimes called the China Syndrome.

Huge billows of radioactive gas would then escape into the atmosphere and rain down on the surrounding population.

Thousands would die within days from radiation poisoning. Thousands more would die for years afterwards from cancer and leukemia. Property damage would soar into the billions of dollars.

Fortunately, a complete meltdown has never taken place, although there have been close calls. Officials admitted that Reactor 2 at the Three Mile Island plant in Harrisburg, Pennsylvania came within 30 to 60 minutes of meltdown during the accident which occurred on March 28, 1979. Only luck prevented a total catastrophe.

BARRING A meltdown of the fuel bundles, there is the danger of radioactive gases produced during a Loss of Coolant Accident (LOCA) due to fuel failure (the rupture of the metal fuel sheathing as a result of overheating of the reactor core). If these gases were to escape into the atmosphere, possibly as the result of a chemical explosion in the reactor building, the health threat to the residents of the area would be severe.



AECL DIAGRAM of Pickering reactor. The splitting of uranium atoms creates temperatures of 1000 degrees Centigrade. It also creates 1000 Hiroshima bombs worth of radiation in each reactor core.

Again, an accident of these proportions has yet to occur (although some say the venting of low-level radioactive gases during the Three Mile Island accident did affect the health of animals and human beings who were exposed to these gases).

However, there have been a number of major accidents involving contamination of the inside of the reactor building, and exposure of the plant and clean-up workers.

In 1952, the NRX reactor at Chalk River boiled over when a worker's error led to jammed control rods. More than 4.5 million litres of highly radioactive water spilled into the reactor building basement, and a meltdown was only narrowly averted. (The reactor was a CANDU prototype design.) Workers had to be brought in to help with the de-contamination, which involved scrubbing every square centimetre of the eight-storey NRX building.

In 1958, another experimental reactor at Chalk River, the NRU, was the scene of an equally serious accident. A fuel rod withdrawn from the malfunctioning reactor caught fire and a small piece dropped on the reactor floor. A volunteer crew worked frantically to douse the flames with sand while lethal levels of radiation and fission products filled the building. Hundreds of people were involved in the clean-up, each receiving a brief but potentially dangerous dose of radiation.

ACCORDING TO the nuclear establishment, the chances of a reactor meltdown or any other accident seriously affecting the public are so remote as to be scarcely worth thinking about. The industry points with pride to the reactor safety systems, which operate on a principle known as "defense-in-depth"—if one safety system fails, another is designed to be on hand as back-up.

This sounds impressive, but there have been problems.

Safety systems have not always behaved the way they were expected to behave. As early as 1976 it was discovered that the most crucial reactor safety system in a CANDU reactor, the Emergency Core Cooling System (ECCS), could not do the job it was designed to do. The system could not entirely prevent fuel failure, and possible internal releases of radioactive gas, during a LOCA.

The Atomic Energy Control Board ordered that the Douglas Point and Bruce A stations be operated at less than full power in order to minimize the danger from this deficiency.

Fortunately, steps are being taken to upgrade the Emergency Core Cooling Systems at those two stations, and Ontario Hydro has finally agreed to make similar improvements at Pickering A, which suffers from the same design flaw.

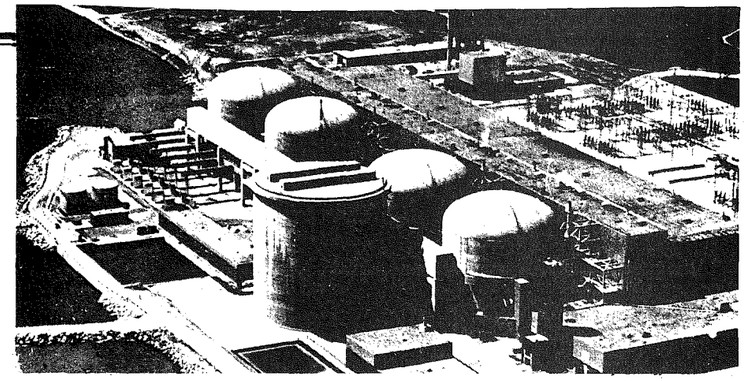
Another cause for concern has been the amount of time that the ECCS and a second safety feature, the containment system (a system designed to contain radioactive gases during an accident), have been technically out of commission in reactors at Pickering and Bruce.

In 1974, a particularly bad year, three out of four Pickering reactors had an ECCS which, according to Hydro's own analysis, was "unavailable" for the entire year. One of these reactors also operated without a properly functioning containment system for half the year.

If an accident had occurred in the reactor where neither system was working, the result would almost certainly have been disastrous.

Although more recent reports appear to show an improvement in safety system availability, it is too soon to be certain that a genuine improvement has occurred. Frequently equipment failures are not discovered until years after they take place.

Finally, let us not forget the warning issued by Bill Taves, a former control room operator at the Bruce plant. In April 1979, writing under the name M. Shultz, Taves revealed that each of the equipment failures and errors which had led to the Three Mile Island accident had already occurred individually at Bruce, and that an accident of the seriousness of Three Mile Island could be repeated in Canada. He demanded a review of nuclear safety, but no such review has since taken place. ■



PICKERING A, Ontario Hydro's flagship nuclear station. In April 1981 Toronto City Council asked the AECB to require that Pickering be limited to 70 per cent of full power. Council is concerned because the station does not meet certain present-day safety standards. Pickering has not been de-rated as a result of the request. However, steps are being taken to upgrade one safety system, the Emergency Core Cooling System.

From mining to spent fuel

THE NUCLEAR REACTOR is only one link in the nuclear fuel chain. Each link of the chain poses its own dangers:

- **Uranium mining. Danger of radiation-induced cancers for miners; danger of environmental contamination and health threat from uranium tailings, which are radioactive, acidic, and toxic.**
- **Uranium Refining. Some health danger for refinery workers. Environmental contamination from refinery wastes, which are radioactive and toxic, and which are kept in primitive and ineffective dumps.**
- **Reactor Operation. Danger of a major reactor accident, producing release of highly radioactive gases. Also, possibility of low-level leaks from less serious accidents.**
- **Spent Fuel Disposal. Danger of spills of highly radioactive reactor waste during transportation. Long-term danger of leaks after disposal. Waste contains plutonium, which remains deadly for a quarter of a million years.**
- **And Beyond. Possibility of spent fuel re-processing to upgrade plutonium content for re-use in reactors. Waste from this process is liquid, and exceedingly dangerous.**

RADIATION

There is no safe level of exposure

BASED ON EXPERIENCE in Nagasaki and Hiroshima scientists can estimate with some confidence the radiation effects of a very serious nuclear accident.

The U.S. government dropped atomic bombs on these two Japanese cities in 1945. Many thousands were killed instantly, as a direct result of the detonation, and many more died within a few hours or days due to cell damage caused by high radiation exposure.

Thousands more have died since from leukemia and cancer as a result of this exposure (there are still about 100 deaths a year due to the Hiroshima bomb).

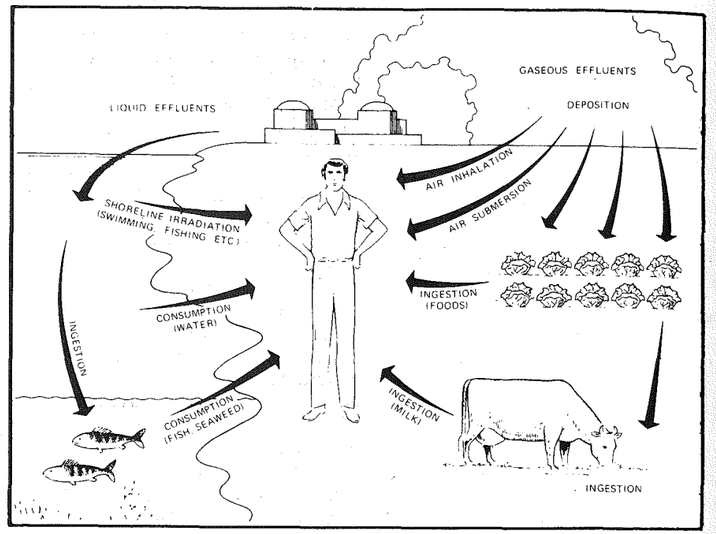
There is no question that high-level radiation is one of the deadliest threats to human health.

However, the effects of lower levels of radiation are more controversial.

At one time, many scientists assumed that there was a threshold below which radiation doses would not be harmful to human beings.

More recently, the threshold hypothesis has been replaced by the linear hypothesis. The important difference with this theory is that there is *no safe level of exposure*; any dosage can have some effect. With the linear hypothesis, the risks of cancer and leukemia are considered to be proportional to the level of exposure.

But there is also a group of scientists who believe that even the linear hypothesis underestimates the dangers of some kinds of low-level radiation. These scientists are mostly concerned with the long-term effects of low-level radiation on atomic workers and others who may be exposed as the result of uranium mining, transportation, nuclear waste disposal, or "minor" nuclear accidents.



THE PATHS OF radioactivity to the human body. Exposure need not be direct—the radioactivity can be carried by wind and water, and it can be passed through the food chain, from one organism to another, before reaching human beings.

Canadian regulations permit members of the public to be exposed to 500 millirems a year and atomic workers to be exposed to 5000 millirems a year. The standards refer to "acceptable" and not necessarily safe levels. (A millirem is a measure of radiation damage to human tissue.)

Even the original source of these standards, the International Commission on Radiological Protection, admitted that they were somewhat arbitrary. The ICRP said it lacked sufficient information on which to base reliable standards.

Although a great deal of money has been spent on research, it is very difficult to determine the precise health effects of a given dosage of radiation. This is partly because effects such as cancer and birth defects take so long to show up, and partly because there are other factors, including smoking and environmental contaminants, which can produce the same results.

Nevertheless, the British Columbia Medical Association feels that there is enough evidence of danger from extended low-level exposure that it has called for an Emergency Task Force to provide an independent review of Canadian standards, with a view to significantly lowering permissable levels of exposure. ■

URANIUM MINING

A threat to miners, environment

MINING

ALL MINING IS hazardous, but uranium mining is particularly hazardous. The special dangers of uranium mining include silica dust, which can cause silicosis of the lungs, and alpha and gamma radiation exposure, which can cause cancer.

In 1974, the Ministry of Health and Welfare announced what had been known in government circles for at least five years: that uranium miners are at least twice as likely to die from lung cancer as the average citizen.

Shocked by this news, the miners at Elliot Lake went out on strike, demanding safer working conditions. They also wanted an end to confusion about who was responsible for regulating their health and safety — the provincial or federal government.

As a result, the province established a Royal Commission (the Ham Commission) on occupational health in the mining industry. The Commission's report led to an important new piece of legislation, Bill 70, which gives Ontario workers the right to refuse unsafe work.

However, this legislation does not apply to uranium miners. Just before Bill 70 was to come into effect, the federal government decided that it was after all responsible for the health of uranium miners, and that the miners would be covered under the federal Labour Code.

Under this code, miners can refuse work only when there is imminent danger (when, for example, there is reason to expect a cave-in), and not when working conditions are merely unsafe (when, for example, radiation reaches levels which may pose a long term health threat).

The Ham Commission found that uranium miners had long been subject to high levels of radiation exposure, due to inadequate standards and due to inadequate enforcement of these standards. Since 1975, protection has improved somewhat. However, the miners are still concerned about the adequacy of mine ventilation, respirators, and radiation monitoring.

Even if the current protection were adequate, we would continue to see the effects of past abuses for years to come. Cancer can take up to 30 years to develop.

TAILINGS

URANIUM IS FOUND in the earth in very low concentrations. Even a typical ore body contains less than three pounds of uranium "yellowcake" per ton of material mined. So mining a little uranium means digging a lot of dirt. And this dirt is radioactive.

By 1976, the uranium mines in Elliot Lake, Ontario had generated a total of over 80 million tonnes of this dirt, known as tailings. The tailings had been simply dumped onto the landscape, in some cases filling in entire lakes. Although attempts were made to prevent leaks into the surrounding water system, the Serpent River became severely contaminated with radioactive radium, acidity, ammonia, and other toxic pollutants from the tailings.

As a result of the contamination, there are no fish living in the Serpent River for 55 miles downstream.

Recent efforts to improve tailings management include the establishment of treatment plants to trap the radium, and the use of lime to neutralize the acidity in the wastes.

However, an 1979 Environmental Assessment questioned whether the radium could be permanently isolated from the water system. Questions were also raised about the long term effectiveness of the new, improved dams which have been built to contain the run-off from the tailings.

There are also continuing

DESOLATE SCENE near Elliot Lake. The tailings are toxic, radioactive, and acidic—and there are over 80 million tonnes of them.

questions about the health effects of the radioactive radon gas which is given off by the tailings, and which may travel considerable distances before being dispersed.

Environmentalists have criticised the industry for failing to research and implement safer long-term approaches to tailings and management. These approaches include immobilizing the wastes in asphalt and placing them underground.

In Ontario, uranium is mined at Elliot Lake and Bancroft. Mining is also expanding quickly in Saskatchewan. British Columbia, on the other hand, has imposed a seven year ban on uranium mining in response to public pressure and concern about the effects of mining on the environment and the health of miners.

Native peoples across the North have actively opposed uranium exploration and mining as a threat to their lifestyle and environment. ■

RISKS

What is acceptable? We must decide.

NUCLEAR ADVOCATES like to compare the chances of being killed as the result of a nuclear accident with the chances of being killed in, say, an automobile accident or a meteor shower.

On the basis of these comparisons nuclear power looks very safe indeed. You may even hear the claim that nuclear power is the safest form of energy available—safer even than solar power.

Beware of such statements. The studies on which they are based have been heavily crititized in scientific circles for their subjective methods and assumptions, and in some cases for their mathematical accuracy. In general they are thought to seriously underestimate the dangers of nuclear power.

For example, these studies look only at the dangers of a reactor accident, not at the dangers of uranium mining and refining, and nuclear waste disposal. Nor do they take sufficient account of the possibilities of operator error in the reactor control room; of design error, or of damage to a reactor from natural disasters or terrorist or military attack.

However, it may be foolish even to attempt to be mathematically precise about the dangers of nuclear power. If our experience to date has taught us anything about nuclear it is to expect the unexpected. Accidents have usually occurred because of some unpredicted and unpredictable combination of factors. The chances of each of these accidents were thought to have been unbelievably low, and yet they have happened.

Under the circumstances it is probably wisest to take heed of Murphy's Law, which says that if something can go wrong, it will. Instead of insisting that a serious accident is so unlikely that it is not worth considering, we should assume that the worst *will* happen some day, and then decide whether we are willing to accept the consequences.

> "Nuclear energy is not a mere engineering problem that can be solved with sufficient care, but a wholly new type of problem that can be solved only by infallible people. Infallible people are not now observable in the nuclear or any other industry."
>
> Amory Lovins

THE ARGUMENT of last resort for nuclear advocates is that progress cannot be achieved without taking risks. If our ancestors had not taken risks, they say, we would still be living in caves and dressing in animal skins.

This is true up to a point—risk-taking is often necessary if we want to accomplish something of value. But it does not follow that all risky ventures lead to a desirable form of progress. The question is whether the benefits of nuclear power are *worth* the risk, and whether there are safer, better ways to achieve the same (or greater) benefits.

Finally, and perhaps most importantly, nuclear advocates seem to forget too easily that it is not their business to decide for us whether the risks of nuclear power are acceptable. Since it is we who must live with these risks, we should be given candid information about the true dangers of nuclear power, and we should have the opportunity to decide for ourselves whether the risks are acceptable. ■

URANIUM REFINING

Eldorado's record: not very good

DURING THE SECOND World War, Eldorado Mining and Refining of Port Hope refined uranium for use in America's Manhattan Project, which developed the atomic bombs dropped on Hiroshima and Nagasaki in 1945. The firm continued to supply uranium to the U.S. and Britain for the Cold War arms build-up following the war.

Today, renamed Eldorado Nuclear Ltd., the federal crown corporation no longer exports directly for the arms trade. Eldorado now produces about 1000 tonnes a year of uranium dioxide (UO2) for use in CANDU reactors. It also produces about 5500 tonnes a year of uranium hexaflouride (UF6) for export to countries with reactors requiring enriched fuel.

Eldorado has a poor environmental record.

During the Fifties, radioactive wastes and rubble from the firm's old radium refinery were distributed for use as fill and construction materials throughout the town of Port Hope.

The citizens of the town were not made aware of the radiation danger from these materials. In fact, nothing was done about it until after an Energy Probe investigation in 1975 and a CBC documentary on the problem.

In the face of mounting public concern, the Atomic Energy Control Board (AECB) finally decided to "do a proper job" of cleaning up the town. A school was closed for two years and dozens of hot spots were identified.

By the end of 1979 almost 100,000 tonnes of fill had been removed—at a cost to the taxpayer of $7 million—and there are an additional 180000 tonnes left to be removed.

MEANWHILE, ELDORADO'S refinery waste dumps have been leaking radioactivity and arsenic. The current dump at Port Granby, which contains over 450000 tonnes of low-level radioactive wastes, is only 25 metres from the shores of Lake Ontario.

In 1976, Eldorado was ordered to shut down the Port Granby dump.

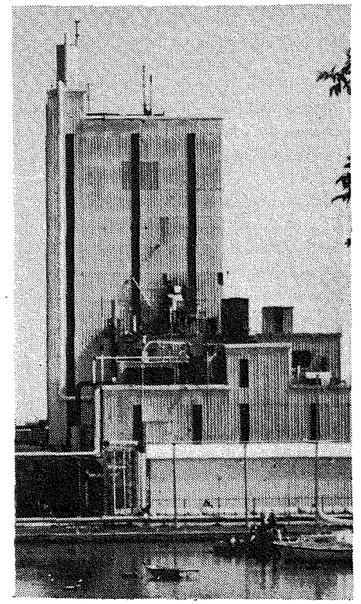
The shut-down order was lifted soon afterwards when Eldorado promised to improve the site and to establish a proper treatment facility.

Although certain corrective measures have been taken at Port Granby, they don't appear to have been very effective. As late as 1980, contaminated liquid waste was still seeping or spilling into Lake Ontario.

Eldorado is still using the Port Granby dump.

ELDORADO HAS also been guilty of permitting spills from its refinery directly into Port Hope harbour. The federal crown corporation is now fighting charges laid by the Ontario Ministry of Environment regarding one such spill. Eldorado says that as a federally-owned firm it is not subject to provincial environmental laws.

A further indication of Eldorado's disdain for the environment and the public surfaced in May of 1981 with the news that the refinery had been spewing out uranium dust at 25 times the highest previous levels. The AECB, Environment Canada, and the provincial environment ministry all expressed astonishment and concern that Eldorado has failed to inform them of the emissions. An Environment Canada official was blunt: "I think it's inexcusable. I don't know what goes on in their minds. They just seem to go from problem to problem. . . " ■



THE PORT HOPE operation is still Eldorado's only refinery. But the federal crown corporation has big plans. A refinery is now under construction in Blind River, despite local opposition, and a second plant is slated to be built within the town of Port Hope. These refineries will produce uranium hexaflouride for export; the wastes will remain in Canada. A proposal for a third refinery in Warman, Saskatchewan was rejected by an Environmental Assessment Review Panel when local residents expressed determined opposition to the project.

WASTE DISPOSAL

Spent fuel—an enduring problem

ABOUT 3500 METRIC tonnes of high-level nuclear reactor wastes are now in temporary storage in water-filled pools at Ontario's nuclear stations.

By the turn of the century Ontario Hydro will have accumulated over ten times that amount — over 200 kilograms a day for each Pickering-sized reactor.

A safe, permanent disposal method for these wastes has not yet been demonstrated.

In this country, Atomic Energy of Canada Ltd. (AECL) is taking primary responsibility for nuclear waste disposal research. According to AECL the most promising disposal method is to create storage facilities in hard rock formations deep in the Canadian Shield. This method involves drilling into these formations, known as plutons, and inserting the wastes. The wastes would be surrounded by various barriers designed to isolate the radioactivity from the environment.

However, many questions remain to be answered before hard rock disposal is proven to be safe.

An acceptable waste disposal method must be able to isolate highly-radioactive wastes, perfectly, for hundreds and even thousands of years. (The minimum estimate is 700 years, by which time the industry says the radioactivity in the waste will have decayed to the levels found in the original uranium ore. However, the distinguished nuclear physicist and health scientist, Dr. John Gofman, maintains that waste disposal must accomplish the impossible — 99.999 per cent containment for some 250,000 years. A quarter of a million years is about the length of time it would take for the Plutonium-239 in the waste to lose half of its initial radioactivity.)

Over the centuries anything can happen. Civilizations can rise and fall. So it is impossible to guarantee that anyone will be around to take proper care of a waste disposal site.

There are also questions about the long term stability of the rock. Even rock as solid as the Canadian Shield may shift and crack, releasing radioactivity.

Spokesmen for the Geoscience Council of Canada have warned against leaping to conclusions about hard rock disposal. The Council, which represents Canadian geologists and earth scientists, says that our geological and hydrogeological knowledge of the Shield is still very limited, and that it would be dangerous to opt for the hard rock solution without many more years of research.

AT THIS TIME there is still no way of knowing whether an acceptable disposal method will ever be found.

Some people are so concerned about this aspect of nuclear power that they feel it is irresponsible for us to continue with our present nuclear expansion programme.

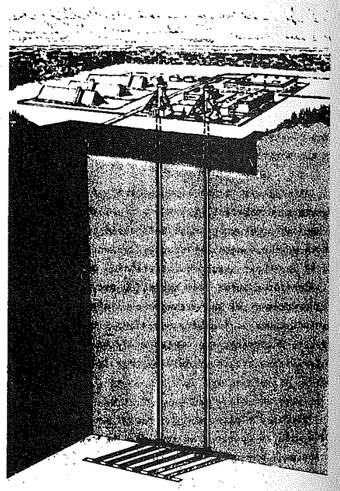
In 1978, the Canadian Medical Association passed a motion demanding a halt "to the further development of uranium mining and reactor construction until a safe, proven permanent disposal technology is developed for the wastes that have already been generated."

The State of California has actually imposed such a ban.

Ontario's Royal Commission on Electrical Power Planning (the Porter Commission) professed faith in the hard-rock research now underway. But the Commission indicated its lingering doubts when it called for a moratorium on further nuclear development if progress towards waste disposal has not been achieved by 1990.

ASSUMING SCIENTISTS find a waste disposal method they feel is safe, a serious question remains: where?

AECL has already met fierce opposition from local citizens throughout Northern Ontario



ARTIST'S RENDERING of a demonstration deep-rock disposal facility for spent nuclear fuel wastes (cut-away view). The safety of this disposal method has not yet been proven.

"Waste disposal is not a technical problem; it is a public relations problem."
A.M. Aiken
former vice-president
Atomic Energy of Canada Ltd.

even to the prospect that their area be used for research.

When it comes time for an actual waste disposal site to be established, opposition will no doubt be even fiercer. (Witness the recent refusal by the citizens of Bancroft to accept low-level radioactive soil from a Scarborough subdivision).

Wherever a waste disposal site is built, neighbouring residents will have to live with fears of a spill of high level reactor wastes during transportation or unloading. They will also have to live with fears of long-term leaching of radioactivity from the disposal site.

However remote the possibility of these accidents, no one is likely to welcome a nuclear waste disposal site in his or her backyard. The question will emerge: does anyone have the right to force a community to live with the dangerous by-products of a technology they did not choose and which, as we have seen elsewhere in this booklet, is not needed?

PLUTONIUM

Deadliest of the deadly

SPENT REACTOR fuel contains considerable quantities of Plutonium-239, a radioactive isotope which can be re-processed to be used as reactor fuel.

Canada has not yet built a large scale re-processing plant, but as uranium supplies are used up we may be tempted to do so in order to conserve fuel.

There are two main problems: plutonium is one of the most lethal substances known to human beings (one millionth of a gram, if inhaled, can cause death within days); and plutonium can be used to make atomic bombs.

If we begin re-processing plutonium in any quantities it is almost certain that there will be a disastrous spill.

And according to Dr. Theodore Taylor, a designer of atomic bombs for the U.S., stolen plutonium could be used in a crude, home-made atomic bomb. This opens up the possibility that terrorists or organized crime could come into possession of a weapon with terrible destructive powers. ■

COAL VS. NUCLEAR

Nuclear's no substitute

"My own instincts tell me nuclear power has been accepted by Ontarians. I expect some critics to disagree. That's fine. But don't then come to me and complain about acid rain."
Ontario Premier Bill Davis
February, 1981

PREMIER DAVIS tells us that we must embrace nuclear power or else accept the consequences, namely the continued production of electricity with coal-fired generating stations.

Hydro's coal-fired plants are known to be significant contributors to the acid rain which is now killing 48,000 Ontario Lakes. Nuclear power is put forth as a more environmentally acceptable alternative.

However, this argument does not stand up.

For one, Ontario Hydro does not intend to replace its coal-burning capacity with nuclear. Hydro's expansion plans include more of both.

Furthermore, Ontario's coal-fired generating plants need not contribute to acid rain. Ontario Hydro has only to install scrubbers on the stacks of all of these plants. Scrubbers have been developed which are capable of removing up to 95 per cent of the sulfur dioxide in flue gases.

Although the Ministry of the Environment has ordered Hydro to reduce its emissions 40 per cent by 1990, most of the reductions will not occur until after 1985. In the meantime, Hydro's acid-producing emissions will actually increase by 30 per cent during the early Eighties due to increased exports of electricity to the U.S. and increased domestic consumption.

These facts call into question Premier Davis' commitment to reducing Hydro's contribution to acid rain.

More in keeping with the urgency of the situation would be a provincial order requiring the immediate adoption of every technically feasible means of reducing emissions. Better still, the province could move to reduce the demand for coal-fired electricity by encouraging the adoption of conservation measures and environmentally-compatible energy alternatives. ■

DEMAND FOR NUCLEAR

Growth rate is falling dramatically

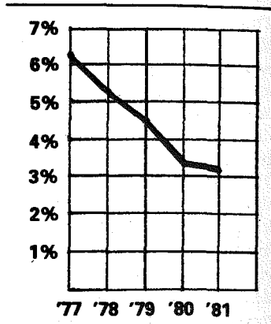
IN THE SEVENTIES reality began to catch up with Ontario Hydro. The rate of growth in electrical demand had begun to slow drastically from historical levels of six or seven per cent a year.

Partly this was because rising prices and international events forced people to become more conscious of the need to conserve. Partly it was because we were running out of new ways to use electricity — we already had all the electrical appliances we could buy, and growth in the economy was shifting from the manufacturing sector, where energy use is high, to the service sector (retail stores, restaurants, etcetera) where energy use is relatively low.

But one thing was obvious: Hydro's planners could no longer predict future demand by simply extrapolating the ultra-high growth rates of the past. Growth had slowed, and with it the demand for nuclear power.

Hydro was slow to respond to the new reality. But eventually the utility came to see that its critics were right. In 1979 the predicted annual growth rate to the year 2000 was lowered from 5.3 per cent to 4.5 per cent. In 1980 it was lowered again to 3.4 per cent. And in 1981 it was lowered once again to 3.1 per cent.

These percentage reductions might seem small, but they add up to a great deal when compounded over the years. In 1974, Hydro was predicting that it would have to meet a demand of 83,000 megawatts by the year 2000; by 1981 that figure had dropped to 31000 megawatts. The difference between the two is the equivalent of 15 Darlington-sized stations — at a cost of almost $7 billion each.



RECENT TRENDS in Ontario Hydro's long-term forecasts of average annual growth in peak electrical demand. Hydro's predictions remained above seven per cent through the early 70s.

THE DOLLAR CRUNCH

Nuclear generates debt as well as power

NUCLEAR STATIONS are phenomenally expensive. Darlington is slated to cost almost $7 billion. That's almost $1000 for every man, woman, and child in the province. And if Hydro's past record with cost overruns is any indication Darlington will end up costing a lot more than $7 billion by the time it is finished.

For this reason, Hydro should be very certain that it can sell the power from Darlington before the station is built. If not, Hydro's revenues will not be adequate to meet the payments on the money it will have to borrow in order to build the plant.

And if this happens, Hydro's customers — the people of Ontario — will find that their rates must be raised in order to pay for the unused plant.

Hydro already owes over $13 billion, a huge debt for a single provincially-owned crown corporation. This debt is at least partly due to Hydro's past record of over-building nuclear power generating capacity.

In the recent past, Hydro has come close to 50 per cent excess generating capacity (the normal reserve margin is 25 per cent). With Pickering B, Bruce B, and Darlington scheduled to come on stream in the next decade, we can expect continued surplusses of electrical generating capacity.

Some analysts predict disaster unless Hydro brings its debt under control. Under the pressure of escalating debt, the utility would have to raise its rates, resulting in declining consumption due to conservation and substitution. This would force Hydro to raise its rates even higher, in turn stimulating more conservation. Ultimately Hydro could become unable to meet its financial obligations and its owners, the people of Ontario, would be left with responsibility for paying off an unbelievable debt. ■

Many critics predict that Hydro's growth projections will continue their downward trend.

And yet the Ontario government has recently announced that construction of the Darlington Nuclear Generating Station would resume, and that the plant would be completed by 1990.

Hydro's forecasting department was shocked by this decision because it had predicted that Darlington would not be needed until much later. Chief forecaster Larry Higgins said the Darlington speed-up "kind of puzzles me. If there isn't a market for it then I wouldn't be enthusiastic about that...Just simply building nuclear plants will create a few jobs, but if the demand isn't there, and there isn't a reasonable certainty that it will be there, until that happens it probably shouldn't be built."

SOME PEOPLE would support the Darlington decision even though it doesn't look today as though the plant will be needed. Better to be safe than sorry, they say, anticipating new demand for electricity as the much-discussed "oil crisis" deepens.

However, it would be a very serious mistake to build a $7 billion plant without a ready market for the power (see The Dollar Crunch, opposite).

Most of the heralded off-oil uses for electricity (home heating, hydrogen) are inappropriate and expensive. There are cheaper, better alternatives, including conservation, natural gas, solar, and biomass (see below and sections on Conservation and Alternatives, pages 22 to 27).

The small increases which are expected in electrical demand can be met satisfactorily with co-generation and undeveloped hydro power (see Alternatives, pages 23, 24). ■

HYDROGEN

Another costly, large-scale technology

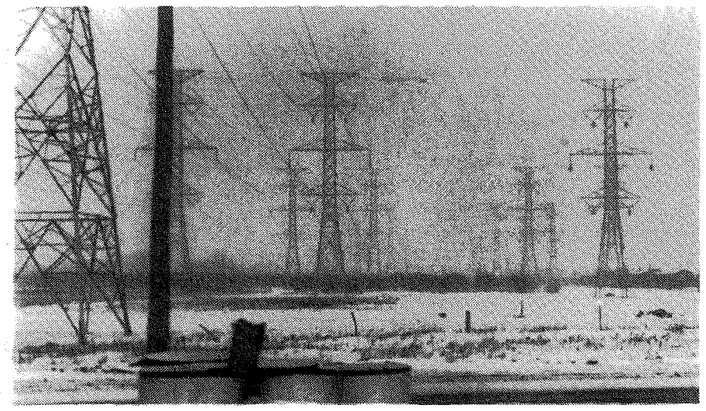
HYDROGEN IS A gas which can be burned in an internal combustion engine or converted to electricity by means of a fuel cell. It is colourless and odourless, and its enthusiasts contend that it is relatively safe, wondrously flexible, and completely non-polluting. Hydrogen also exists in unlimited quantities: together with oxygen it is the main constituent in ordinary water.

But hydrogen is not available naturally. It has to be produced. In Ontario this would be done by running an electrical current through water in a process known as electrolysis. Thus hydrogen is not an *energy source,* it is only an *energy currency;* it is a way of converting electricity into a form in which it can be stored for future use.

The Ontario government sees hydrogen production as a new and exciting use for nuclear power. Ontario Hydro wants to build a hydrogen plant at its Bruce Nuclear Generating Station, and the provincial government has committed funds to research the application of hydrogen to public transit. A federal government committee has come out in favour of a five-year $1 billion programme to develop hydrogen as a replacement for fossil fuels in a "hydrogen-based energy economy" of the future.

However, hydrogen development has been criticized because it means more nuclear power, and because it means subsidies and research efforts will be devoted to yet another large-scale, centralized energy technology while conservation and small-scale alternatives remain under-funded.

Critics also point out that hydrogen is too expensive to be practical for most uses. Because the gas is very bulky unless compressed in heavy, cumbersome tanks, hydrogen-powered automobiles have a very short range before re-fuelling — only about 100



ELECTRICAL transmission lines use up scarce farmland. Centralized power generation makes them necessary.

miles.

Even the supporters of hydrogen admit that their dream of a hydrogen-based energy economy is a long way off. Energy Probe's Norman Rubin doesn't think hydrogen will ever be economically practical. He calls it, "another turkey that will have to be subsidized like crazy before it will limp — and it will never fly." ■

POWER EXPORTS

Count the costs carefully

EXPORTING "SURPLUS" electricity to American utilities might sound like a good idea at first, but we have to be very careful about how we calculate the costs and benefits to the people of Ontario.

For example, Hydro has recently signed an electricity export contract which will result in the use of coal generating stations which would otherwise sit idle. As a result of the exports and increased domestic use, Hydro's contribution to Ontario's acid rain problem will increase by 30 per cent in the early Eighties.

If Hydro's own emissions are on the rise it makes it difficult for Canadians to get tough with the Americans about reducing their contribution to acid rain.

Even more questionable is the proposal that Ontario build nuclear plants purely in order to export the power to the United States.

If Americans want nuclear-generated electricity it seems they should incur their own debt, take their own risks, and dispose of their own wastes.

The Porter Commission adds that U.S. long-term electrical demand, like Ontario's, is very hard to predict. It would be a very serious mistake to build capacity for export only to find that there is no market for the power. ■

ELECTRIC HEATING

Not as cheap as it looks

ACCORDING TO THE electrical industry, electric space heating (for homes, offices, etcetera) will become cheaper than heating with natural gas by the end of the decade. On the basis of this prediction, the industry hopes to convince homeowners to switch to electricity rather than gas as they move away from oil.

However, the wisdom of electric space heating has been challenged.

The industry's predictions are based on the assumption that electricity will continue to be sold at artificially low prices. Today's electricity prices do not reflect the various subsidies Ontario Hydro receives as a crown corporation (no taxes, publicly-backed loans); nor do they reflect the higher costs of supplying electricity for heating during periods of peak demand in winter; nor do they reflect the costs of building expensive new generating capacity to meet additional demand.

Economists, small business and consumer groups, and government reports all agree that electricity prices should be raised. Electric heating should have to compete on equal terms with the alternatives, including oil, gas, propane, solar, and most importantly, conservation.

The Porter Commission recommends that homeowners invest in much higher levels of insulation before considering a switch to electric heat. Porter also recommends that higher prices be charged for electricity in winter to discourage further additions to the winter peak demand. ■

CONSTRUCTION HAS resumed, full speed ahead, on the Darlington Nuclear Generating Station near Bowmanville. The provincial government has asked Hydro to go ahead with the 3500 megawatt plant, despite the lack of demand for the electricity it will generate. Photo, May 1981, by Millyard.

NUCLEAR INDUSTRY

On the rocks despite large subsidies

CANADA'S NUCLEAR industry is in serious trouble. The industry, which claims to employ over 40,000, needs a minimum of one to two reactor sales a year just to survive. But with the continuing slump in domestic and foreign purchases, it simply cannot expect to meet that target.

According to a report commissioned by the federal government, the Canadian nuclear industry may not be able to stay afloat — with or without massive infusions of federal aid.

In past, nuclear was heavily subsidized on the principle that it was a fledgling industry which would soon take off on its own. In the 20 years between 1958 and 1977, the federal government spent over a billion dollars on nuclear research alone.

Other federal and provincial subsidies have included give-away financing for reactor exports (Argentina, the prospective sale to South Korea), and exemption from liability for environmental contamination (Eldorado in Port Hope, mining companies in Elliot Lake).

The recent decision of the Ontario government to resume construction of the Darlington Nuclear Generating Station appears to be another example of subsidy to the industry. Although the need for Darlington has been widely questioned, there is no question that firms in the nuclear business were desperately hungry for contracts.

But if the nuclear industry requires such transfusions of outside help to stay alive, why not remove the support and allow it to die a natural death?

There would be some displacement of jobs, to be sure, but very few people in the nuclear industry have skills which could not be put to use elsewhere. Inventive engineers are badly needed to design energy-conserving buildings and equipment, to give just one example. And the industry's turbine- and boiler- making capability could be put to use harnessing industrial co-generation capacity (see Co-generation, page 24).

According to the Science Council of Canada, we would actually be better off in terms of employment if the money currently invested in nuclear power were invested elsewhere in the economy.

SOME PEOPLE argue that Canada's nuclear skills are too valuable to be lost, and that we will come to regret it if we allow the industry to die.

But CANDU has already had plenty of opportunity to make it in the world market, with little sign of success. Nor are there prospects of a renewed domestic sales. Even Ontario Hydro, an avid fan of nuclear, says that it views nuclear as merely a "bridge" to an energy economy based on conservation and renewables.

If we are concerned about preserving Canadian technological capability in specialized fields, there are other fields more worthy of support. For example, the Brace Research Institute in Montreal is recognized as a world leader in the development of appropriate technology. Why not build further on beginnings such as these? ■

REACTOR EXPORTS

Overseas sales no answer

INCREASED EXPORTS are not the answer to the malaise of the Canadian nuclear industry:

- There have only been four CANDU reactor orders since 1973, despite vigorous promotion;
- The 1973 sale to Argentina will end up costing the Canadian taxpayer $130 million more than we will get for it. Romania may not have the resources to pay for the two 600 megawatt reactors it has apparently agreed to buy. And a prospective reactor deal with South Korea includes a loan, courtesy of the Canadian taxpayer, at the incredibly low interest rate of eight per cent.
- In 1974 India diverted spent fuel from a Canadian-designed research reactor and made a bomb with it. Pakistan and Argentina, which also have Canadian reactors, may follow suit. Despite stringent safeguard agreements, there is little we can do to prevent such abuses involving our exported reactors.
- Nuclear power is particularly inappropriate for Third World countries. The benefits and jobs go to a select few while the vast majority are not served by electrical power and could not afford to use it if they were. ■

HARD ENERGY PATH

'Centralizing, vulnerable, inflexible'

ONE OF THE reasons big government and big business like nuclear power so much is that, like them, it's big.

Nuclear power holds out the promise of one big answer to all our energy problems.

And because it involves a small handful of very big projects, nuclear is ideally suited to centralized decision-making in the board rooms of Toronto.

The technology itself inspires awe — it involves magnitudes of concentrated energy and heat beyond our wildest imaginings. Something about that appeals to the powerful.

And the costs of nuclear plants inspire awe as well. Individual contracts are awarded in the hundred of millions, with correspondingly big profit margins.

ENERGY ANALYST Ámory Lovins has a good name for the energy strategy involving large-scale, capital-intensive, complex, and centralized technologies (such as nuclear). He calls it the Hard Path.

The Hard Path has a number of negative qualities.

For one as we have seen, it implies the centralization of power. This undermines individual or community control and initiatives in the energy field.

We become increasingly dependent on the Power Elite — oil companies, Ontario Hydro, etcetera — to provide us with the energy we need to live.

And because they are so big and so scientifically complex, Hard Path technologies begin to seem inevitable. If you question them you are told that you are standing in the way of progress, or that you don't understand science and should not be meddling.

The bigness of Hard Path technologies makes them inflexible and vulnerable.

Because nuclear plants take so long to build it is almost impossible to plan for them with any degree of accuracy. If demand grows faster than expected and more power is needed, it could take eight to 14 years before an additional nuclear plant could be built to meet that need.

But if a plant is built and it turns out that the expected demand has not materialized, the consequences could be even more serious. (See The Dollar Crunch, page 12).

Nuclear plants have been held up as the key to energy security. But in fact the opposite is the case.

If we become dependent on a small number of nuclear stations for a major portion of our energy, then we become very vulnerable to anything which might interrupt that power, including strikes, breakdowns, natural disasters, terrorists, or military attack.

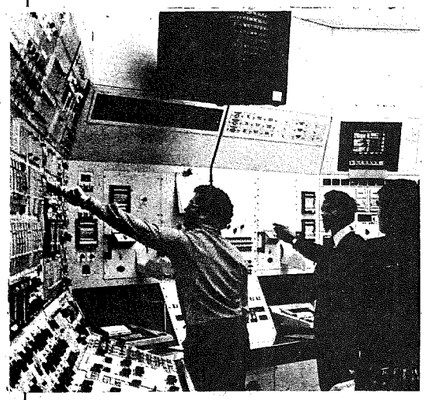
Military strategists have already become concerned about the emergence of nuclear plants as a prime military target. A few well-placed conventional bombs would knock out essential power and release deadly radioactivity at the same time.

Finally, Hard Path technologies like nuclear tend by nature to be environmentally threatening, partly just because they are so big, and partly because they are based on the ideals of technological progress for its own sake rather than technological progress based on human and ecological values.

AS YOU MIGHT expect, there is an alternative to the Hard Path. It's called the Soft Path.

Soft Path technologies are smaller scale, de-centralized, flexible, environmentally compatible, and relatively simple, and they are usually based on renewable (solar, water power, biomass) rather than non-renewable energy resources.

Part II of this booklet examines some of these Soft Path technologies, including conservation, and points toward the possible implications for a new kind of society partly based on these technologies. (See The Conserver Society, page 27). ■



REACTOR CONTROL room. The large-scale centralized nature of hard path technologies helps to promote the concentration of political and economic power which is occuring in our society.

OVERVIEW

Conservation and renewables.

PART II OF the Energy Booklet points to the possibilities for a non-nuclear energy future in Ontario. Here is a wrap up of the conclusions in this section:

- Conservation is the cheapest, most readily available "energy source" left to be tapped. Government energy planners pay lip service to energy saving, but drastically underestimate its potential. With all the concern about "energy security" these days, conservation should be getting more attention — the key to true energy security is not to need so much of it.
- Ontario is heavily dependent on oil and should move to reduce that dependency. Higher oil prices, combined with support for poorer consumers, will inspire more careful use of this scarce resource. Additional Canadian supplies must be developed only with careful attention to the implications for the environment and native rights.
- Natural gas is in good supply and can fill some of the interim requirement for an oil substitute (in home heating, for example). As with oil, additional supplies should be developed only with careful attention to the implications for the environment and native rights.
- Canada also has lots of coal. There may be merit in expanded use of coal if we are successful in eliminating the considerable environmental problems associated with this energy source.
- The Ontario government has promoted nuclear electricity as a 'made-in-Ontario substitute for fossil fuels now being imported into the province. Nuclear would keep money and jobs in Ontario and increase our energy security, the government contends. However, conservation and the development of renewable alternatives would accomplish the same economic goals at less cost, would provide greater security, and would be more environmentally appropriate.
- Demand for necessary electrical uses can be met through undeveloped hydro power, industrial co-generation, and hydro electricity imports, all of which compare favourably with nuclear electricity.
- In Ontario hydrogen would be nuclear in another form.
- Biomass and solar energy show considerable promise. The elimination of subsidies for electricity and oil, and the re-direction of research funds from nuclear power to these renewable energy sources would provide considerable stimulus. ■

CONSERVATION

Live better efficiently

CANADIANS HAVE been branded as the least efficient energy users in the Western World, which should be a source of great embarrassment to all of us.

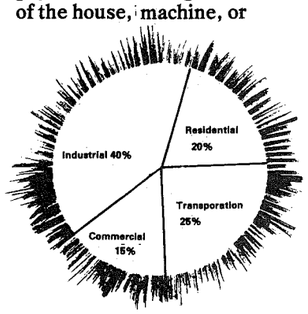
According to a report by the Royal Bank, Canadians waste energy because oil, natural gas, and hydro power have been so cheap, and because government price subsidies favour energy intensive rather than energy saving industries.

Canada uses about three times as much energy per person as Japan, and twice as much as West Germany.

But there is a positive side to all this. Because Canadians are the world's worst energy wasters, Canada also has the world's greatest potential for energy conservation.

We simply have to learn how to eliminate waste and improve our efficiency.

Conservation makes economic sense because the extra cost of installing insulation or improving the efficiency of a manufacturing process is soon repaid in reduced energy costs. In fact, conservation continues to pay for itself throughout the life of the house, machine, or



SECONDARY ENERGY use in Ontario by end-use. Where our energy goes.

other energy-consuming product.

If we were perfectly rational, we would invest in conservation on the basis of "life-cycle costing". That is, we would continue to spend on conservation measures until we ran out of ways of saving energy that would pay for themselves over the entire life of the energy-consuming object.

However, our investments in conservation fall considerably short of this high standard, for several reasons:

- a lack of knowledge about cost-effective conservation measures;
- a lack of funds to carry out these measures, even though they will pay for themselves;
- the price of energy, which is artificially low due to government subsidies (tax exemptions, low interest loans to the industry, direct subsidies to the cost of imported oil, etcetera);
- and the selfish, wasteful lifestyle to which we have grown accustomed.

TO GIVE conservation a fair chance, energy prices must be allowed to rise to their proper levels, which has been done in other countries. The money now used to subsidize the price of energy could be used instead to cushion of impact of higher prices on the poor and to assist everybody in getting more out of the energy they use.

Governments also have a role to play in counselling energy consumers about the best conservation investments, in research, and in supporting the development of new conservation-oriented businesses.

A 1979 study showed that if half the $7 billion slated to be spent on the Darlington Nuclear Generating Station were spent on home insulation, more energy for heating would be saved than Darlington would produce in its lifetime.

Although everyone from Imperial Oil and Ontario Hydro to the individual consumer now pays lip service to the idea of conservation, this is hardly enough. The business of saving energy must be raised to at least the same status as the business of finding and recovering it. The articles which follow give some idea of how this might be done.

RESIDENTIAL

Conservation starts at home

ACCORDING TO A 1974 study, homeowners consume just over a fifth of the energy which reaches Ontario consumers. Of this amount, 70 per cent is used for space heating, 10 per cent for hot water heating and 7 per cent for clothes washing and drying.

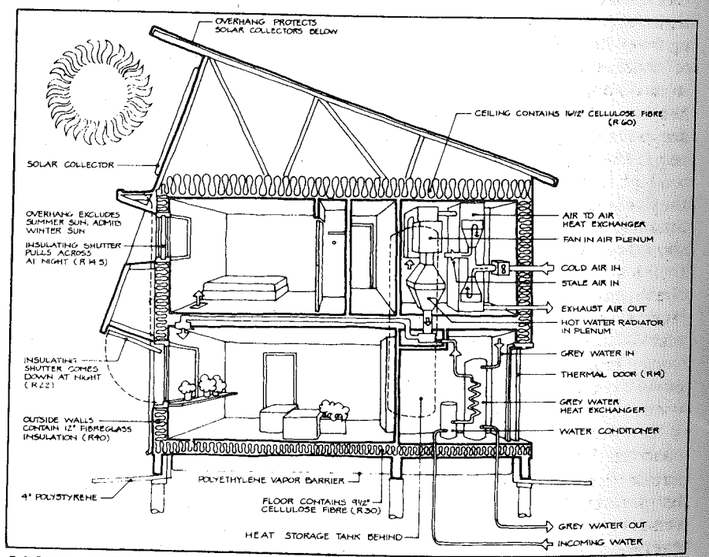
The remaining 13 per cent of residential energy demand is for necessary electrical uses, including lights and motors.

Since most residential energy demand is for low-level heat — heat below the boiling point of water — the potential for simple conservation measures is tremendous.

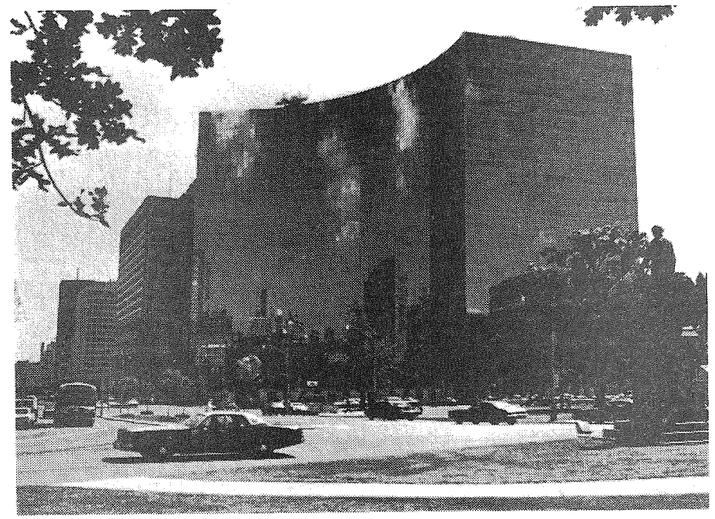
In new houses, conservation measures coupled with solar have reduced energy consumption by as much as 90 per cent. In existing homes, energy use could be reduced by 25 to 50 per cent — or more, with appropriate government policies, including higher energy prices, low-interest loans for conservation, and free conservation advice.

Here is how it could be done:

- super-insulation. Insulation levels far above those recommended by the National Research Council have been found to be cost-effective.
- double-glazed windows.
- insulated shutters or thermal curtains to prevent night-time heat loss through windows.
- heat exchangers. With an air-to-air heat exchanger installed you can seal your house as tight as a drum, using plastic vapour barriers, caulking, and weather-stripping. Fresh air is drawn into the house through the heat exchanger, where it picks up 80 per cent of the heat contained in the stale air which is being expelled. This low-cost investment would create a considerable saving in most homes, in which cold air is constantly leaking in from the outdoors;
- a water-to-water heat exchanger can be used to recover the heat which goes down the drain when you take a shower or a bath;
- improved furnace efficiency. Gas furnaces are now available which are 95 per cent efficient, up from the previous average of 70 per cent;
- new approaches to hot water heating. Most hot water heaters are too big for normal requirements, they're set at too high a temperature, and they're poorly insulated. Smaller, better insulated units should be made available. Utilities could also provide cheap, easy-to-install insulating jackets for existing units, and instruct their consumers to save money by turning down the thermostat on their water heater.
- automatic thermostat controls. These devices automatically reduce house temperature levels at night and raise them in the morning before everyone gets up.
- district heating. Heating each home individually is less efficient than heating all the homes in a district from a single hot water boiler. District heating is common in Europe.



SASKATCHEWAN CONSERVATION HOUSE: note the energy-saving features, including super-insulation, air-to-air heat exchanger, water-to-water heat exchanger, and passive solar design.



ONTARIO HYDRO head office, Toronto. The building is heated by employees, lights, and machines. Surplus heat is stored in a large water tank in the basement and released at night and on weekends.

ONTARIO HYDRO is initiating a programme of $2000 loans at less than market rates of interest to assist its customers in conserving energy and/or converting to electric heat. The programme also includes free conservation advice and inspection of work completed by private contractors.

This scheme is a step in the right direction, despite the unfortunate inclusion of loans for electric heat conversions (you don't have to convert in order to take advantage of the conservation features of the programme).

One drawback is that customers served by local utilities will not be offered the loans and advice unless their utilities decide to participate.

The federal government also offers home insulation grants of up to $500 (but you have to pay taxes on the money as if it were income). ■

COMMERCIAL

"I save at the office."

OFFICE BUILDINGS, stores, schools, hospitals, warehouses and other similar uses account for about 15 per cent of energy demand in Ontario.

Of this amount, most — about 84 per cent — is for low temperature heating and cooling about 13 per cent is for necessary electrical uses; and about three per cent is for transportation purposes in the form of liquid fuels.

In this sector, as in the residential sector, the potential for savings is enormous. The Ontario Hydro building in Toronto and the Gulf Oil Building in Calgary are proof of the savings which are possible — the Gulf building uses about one

fifth of the energy per square used by the average office.

Sensibly designed office towers make use of the heat given off by employees and lighting. This heat can be stored in a giant water tank in the basement for use at nights and on weekends.

Other measures include:

- double glazed windows with silver treated glass to reflect the sun's rays and reduce the need for air conditioning;
- the burning of waste paper to heat the building's hot water;
- the use of special lighting fixtures to get the maximum light out of low-watt bulbs.

Many of the conservation measures which could be applied to existing buildings in the commercial sector are merely common sense, and parallel the measures that could be applied in homes. Here are a few suggestions:

- a double set of doors at store entrances to reduce heat loss in winter and heat gain in summer;
- ceiling fans to circulate the hotter air which accumulates on high ceilings;
- reductions of ventilation, which usually exceeds standards. Changing the air in a building more rapidly than necessary adds considerably to heating and cooling costs.
- better placement of duct work and heating units.

One way of encouraging conservation in the commercial sector is not to allow energy expenditures as a tax deduction. Governments could then use the additional tax revenues to subsidize improvements to commercial energy efficiency. ■

TRANSPORTATION

The road to energy savings

TRANSPORTATION is the second largest energy use sector in Ontario. Getting from A to B consumes over a quarter of all energy reaching the consumer.

Road transport — cars, trucks, and buses — accounts for more than 80 per cent of this amount. The remainder is consumed for air travel, rail, and marine use.

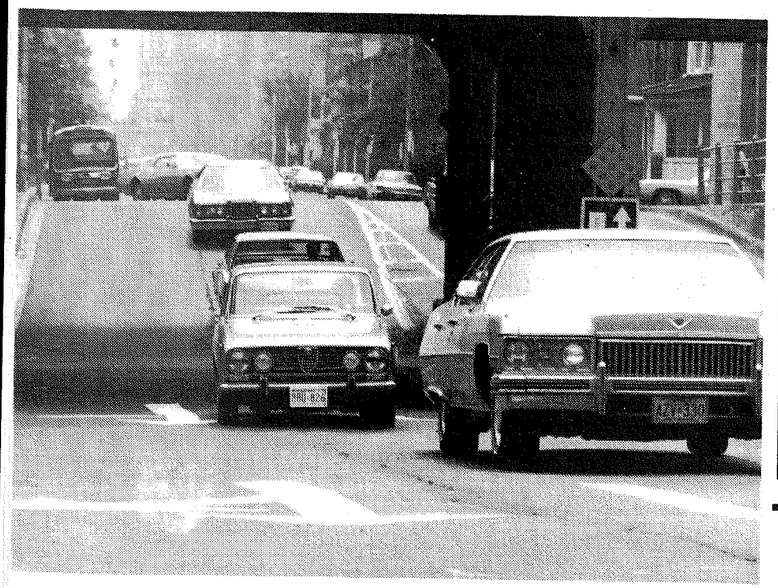
Almost all the energy consumed is in the form of liquid fuels: petroleum products such as gas, oil, and diesel fuel.

The private automobile is the most obvious first target for conservation in this sector. Already, increases in gasoline prices have had a profound effect on automobile purchasing habits — a trend which foreign auto producers were quick to exploit, and to which the beleagured North American industry is now adjusting. Continued price increases for gasoline will accelerate the move to smaller, more fuel-efficient cars.

One proposal would accelerate that trend even more. Energy Probe proposes federal grants to car owners who junk their gas guzzler and buy a more efficient vehicle. The result would be a reduction in the need to import expensive foreign oil, and a reduction in the need for developing expensive new domestic energy sources.

Other measures to reduce energy consumption for transportation include:

- car pools. Governments can help to bring people together who would share rides to and from work:
- bicycle routes. Special bike lanes would encourage this energy-efficient, non-polluting, and healthy form of urban travel. Already bicycle courier services are becoming popular in Toronto for their speed and reliability;
- better driving and maintenance habits. Driving more slowly and keeping your car well-tuned could cut more than ten per cent off your fuel consumption;
- better town planning. The closer people live to work and other common destinations, the less energy they will use getting there;
- more convenient public transit. Bus lanes, transit passes, and improved scheduling information will help to boost transit use; higher downtown parking fees to help discourage automobile use. ■



TRANSPORTATION accounts for one quarter of the energy consumed in Ontario. The private automobile accounts for much of that total.

INDUSTRIAL

Doing more with less

INDUSTRY IS THE biggest energy user in Ontario, consuming almost 40 per cent of the energy which reaches consumers.

Of this amount, almost three quarters is for high temperature heat — heat above the boiling point of water. A small amount is for low temperature heat (5 per cent), while the rest is for necessary electrical uses (15 per cent), and uses requiring liquid fuels (5 per cent).

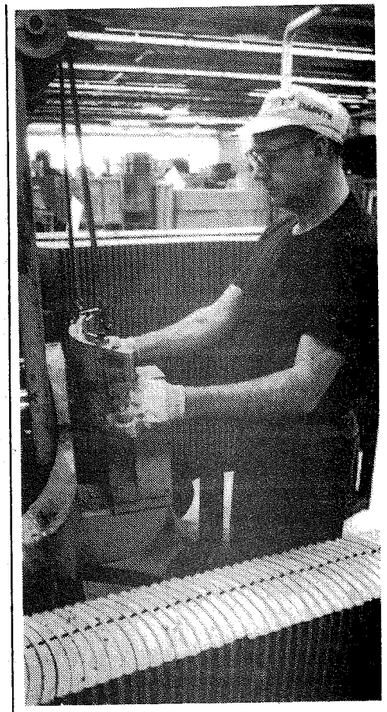
Canadian industry has already begun dramatic reductions in energy use. The major energy consuming industries got together with government in 1976 and set voluntary targets for conservation.

They have been largely successful in meeting these targets: in 1979 energy consumption per kilogram of product was 13 per cent less than in 1972. The industries have set a new goal to trim an additional 10 per cent by 1985, and a federal official predicts they could hit 50 per cent efficiency improvements by the turn of the century or soon after.

A number of measures could accelerate progress towards this goal, including better sharing of information, government tax write-offs for conservation equipment, higher energy prices, and an end to pricing arrangements which give lower prices to big energy users.

Additional conservation measures include:

- recovery of waste heat. Instead of allowing heat to go up the chimney or down the drain, industry can recover it and put it to use;
- improved efficiency in boilers and furnaces;
- more efficient electric motors. Motors could be labelled with an "efficiency index". Controls could be added to adjust the speed and power of motors to the required level, instead of allowing them to run full out and wasting the surplus. ■



WE'RE SOMETIMES given the impression that abundant energy use goes hand in hand with a health economy. But this is not the case—certainly not according to a recent report by the Royal Bank. The report indicates that Japan and Western Europe produce almost twice the good and services that Canada produces per unit of energy consumed. In other words, these economies are almost twice as energy-efficent as Canada's. And if anything they appear to be better off for it. . . Nor does cheap energy go hand in hand with a healthy economy. Western Europe and Japan pay far more for their energy than we do. The Royal Bank study says high energy prices are the main reason these economies have learned to get more out of a barrel of oil . . . One advtange of introducing serious conservation and efficiency improvements in Canada would be a reduction in the need for multi-billion-dollar energy mega-projects, such as oil pipelines and nuclear stations. This would free up capital for other useful and productive investments.

RECYCLING

Save resources and energy

BESIDES SAVING resources, re-cycling often saves energy too. For example, making aluminum from raw ore can take about 20 times as much energy as recycling it, making steel from iron ore and coke takes about four times the energy required for recycling steel.

Some glass is already recycled, thanks to desposits on beer bottles and some pop bottles. More recycling would occur if non-returnable bottles and cans were banned.

Standardization of bottle sizes and shapes would simplify re-use by the manufacturer, and eliminate the need to smash them and re-make them into new bottles, which is also an energy-consuming process.

In the meantime, consumers can help by purchasing recyclable products, by re-using bags and containers, and by avoiding products with unnecessary packaging, especially products in aerosol cans. ■

The energy choices

OIL

We're running out of oil

THERE IS NO question that Canadians have cause to worry about oil. We are heavily dependent on it, international supplies are uncertain, and conventional reserves in the Western provinces are dwindling (to about eight to twelve year's supply at current rates of consumption).

However, there are plenty of questions about how we ought to respond to the "oil crisis".

The first point of contention concerns the federal government's commitment to developing Alberta's tar sands and the frontier reserves in coastal waters and the far North.

The tar sands alone would supply us with at least 50 years of oil at current rates of consumption and the frontier reserves may be capable of supplying a great deal more.

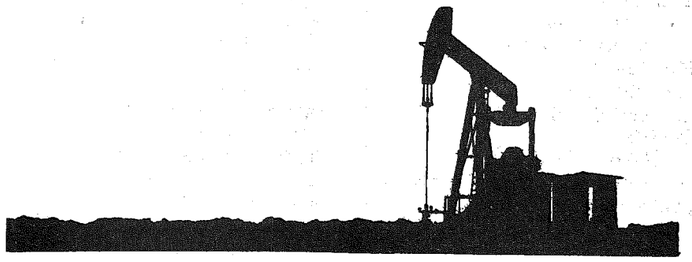
But there are environmental and social problems associated with both tar sands and frontier development, and the building of Northern pipelines may endanger Native rights and Native culture. With care the impact of these problems could be reduced, but they are still black marks against the wholesale development of the reserves which remain in Canada.

Even more to the point is the question of whether we need a great deal more oil.

Further development will be very expensive; it would actually be cheaper to invest in ways of improving efficiency and reducing our oil requirements (home insulation, smaller cars, etcetera.)

Already, higher prices are encouraging conservation — Canadian oil consumption in the first five months of 1981 was down five per cent over the same period in 1980. Governments are making some efforts to encourage conservation, but they could go much further before the cost of saving a barrel caught up to the cost of producing an additional barrel.

Governments have also launched "off-oil" programmes to speed the switch to other energy sources. But these programmes miss the boat by promoting inappropriate oil substitutes, such as electricity for home heating and nuclear-generated hydrogen as a transportation fuel. Now is the time to boost the promising non-traditional alternatives, including solar and biomass, which are already much further advanced in many other countries of the world. ■



NATURAL GAS

But there's lots of gas

CANADA'S NATURAL gas supplies are far more abundant than our oil. The proven reserves in Western Canada are 2000 billion cubic metres (bcm)— that's over 40 year's supply at current rates of production.

Possible new finds could raise Western reserves as high as 4600 bcm, and "frontier" reserves may total another 4600 bcm (although high development costs and concerns about the Northern environment and native rights make these reserves less attractive).

Canada's wealth of natural gas does not mean that we can continue to export huge quantities to the United States. But it does mean that, with proper conservation measures, we have ample supplies to meet our own needs. Indeed, gas is capable of serving as an interim substitute for oil in the home heating market.

The most serious drawback to gas is its environmental impact. Refining produces acid rain. Efforts must be made to eliminate these emissions.

And in the long run gas, again like oil, will become scarce. This is why we must begin now to replace it with renewable energy sources such as solar and biomass. ■

COAL

And lots of coal

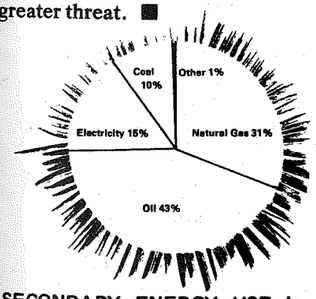
CANADA HAS plenty of coal — enough "recoverable" coal to last another 500 years at present rates of consumption.

The difficulty with coal is that it is an environmental and health hazard.

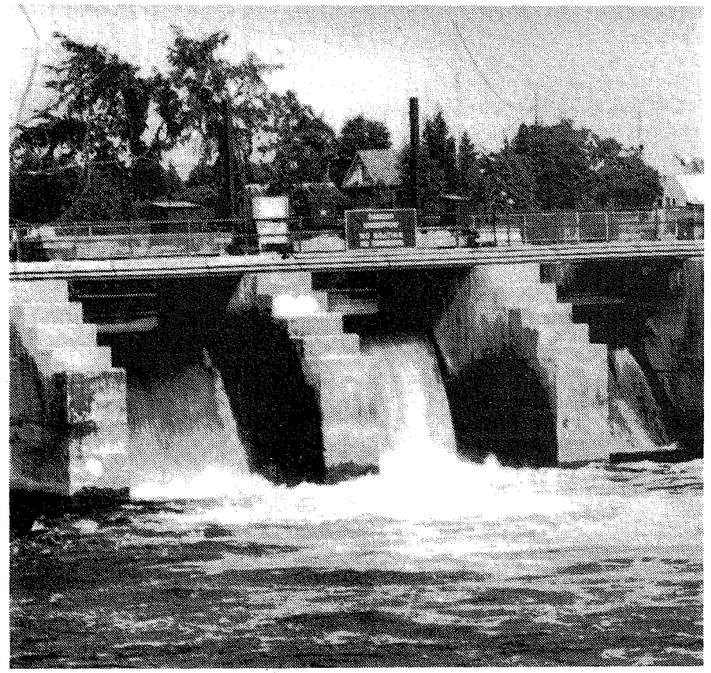
Open face coal mines create great gashes in the countryside. Coal miners suffer from work-related lung problems. Coal-burning contributes to acid rain.

Most of the problems associated with coal can be ameliorated, if not solved, through regulation and technology. A new method of burning coal known as "fluidized bed combustion" is environmentally promising.

But in the meantime we should limit the use of coal to those areas in which the alternatives—nuclear power, for instance — pose an even greater threat. ■



SECONDARY ENERGY USE in Ontario by source. Where we get our energy. Coal and natural gas are also used in the generation of electricity.



A DAM ON the Otonabee River provides half of the electricity for Trent University in Peterborough. Dozens such sites remain undeveloped around the province.

HYDROELECTRIC

Energy from falling water

IN RECENT YEARS Ontario Hydro has maintained publicly that there is virtually no undeveloped hydro power left to be exploited in the province.

This is not so.

A report by Hydro's own Hydraulic Development Section list 8700 megawatts of undeveloped hydro power in Ontario.

The report lists a further 4650 megawatts of undeveloped pumped storage (pumped storage is a way of storing surplus power during off peak periods and making use of it when demand is high.)

And there is another (conservatively estimated) 1300 megawatts of "micro hydro" (less than 2 megawatts for each site).

There are probably good economic and environmental reasons for not developing all of the remaining hydro potential. But there is no doubt that a significant portion can be developed. The 17 "best sites" (over 2000 Megawatts) identified by Ontario Hydro could be built at much lower cost than the equivalent nuclear capacity. Hydro also costs much less to operate, and the expected lifespan of a hydro installation is at least 60 years, double that of a nuclear station.

Furthermore, the environmental impact of these hydro projects would be limited. Each project is relatively small-scale. Much of the undeveloped potential merely requires extending or re-developing existing sites, where the damage has already been done, and much of the rest of it involves placing dams on rivers that have already been dammed.

A recent report by a Hydro economist concluded that at least 10 of the 17 best sites would be so inexpensive to build that work should begin on them as soon as possible.

Yet Ontario Hydro has no plans to develop any of the remaining hydro potential until after the construction of the Darlington Nuclear Generating Station. ■

Hydro imports

BOTH QUEBEC and Manitoba are exporting electricity to the United States. Why don't we buy some of it instead of building more generating capacity in Ontario?

The Porter Commission makes special mention of the possibility of electrical imports and of their potential for reducing Ontario's need to build more nuclear plants. ■

CO-GENERATION

Combining heat and power

THERE IS A LITTLE known untapped source of electricity in Ontario — co-generation. Industries such as steel, pulp and paper, chemicals, food, petroleum, and rubber use a great deal of energy to create high temperature steam for use in manufacturing processes. With co-generation, the steam could be used twice: once to turn a turbine to generate electricity and again for process heat.

The result would be a dramatic improvement in energy efficiency and considerable quantities of electricity which are not now available.

In Ontario today there is about 500 megawatts of installed co-generation capacity, the equivalent of one Pickering-sized reactor. A notable example is the Dow Chemical plant in Sarnia, which generates all its own electricity and has a surplus left over to sell.

According to a report written for the Porter Commission, an additional 2100 megawatts of co-generation capacity could be installed in Ontario by 1990 (about the time the 3500 megawatt Darlington Nuclear Generating Station is scheduled to come into service).

And this figure may underestimate the small-scale co-generation projects which would be cost-effective if financing were available on the same terms that it is available to Ontario Hydro.

The capital costs of installing industrial co-generation capacity are lower than the costs per kilowatt of building new coal or nuclear generating stations. Once it is installed, co-generation does require some extra energy for the generation of electricity, but only about half as much as would be required in a conventional generating plant. In other words, co-generation plants are about twice as efficient as Ontario Hydro's thermal generating plants.

In West Germany almost a third of all electricity is generated through industrial co-generation.

Co-generation plants can also be built from scratch to generate electricity for an apartment or district and simultaneously to produce hot water for domestic use and heating. Inuvik in the North West Territories has such a system. ■

BIOMASS

Energy from living things

BIOMASS IS A catch-all term for all varieties of energy derived from plant or animal products. If you heat your home with wood, you are using biomass. If you use manure, human garbage, sewage or farm crops for energy, you are using biomass.

Here is a run-down of several types of biomass energy available to us:

Hog fuel

ALREADY, WOOD residues from sawmills and pulp and paper mills are used by these mills as an energy source. In 1977, "hog fuel", as it is called, was responsible for four per cent of Canada's energy consumption — considerably more than the 1.3 per cent supplied by nuclear power. (This led one joker to observe: "Canadians split more wood than atoms.") Hog fuel utilization could be increased with policies favouring its use.

Garbage

CITY GARBAGE can be burned directly to generate electricity (watts from waste) or it can be used in the production of ethanol, a liquid fuel. The only danger here is that we will become dependent on garbage

GARBAGE—a potential source of energy.

that need not exist — garbage which consists of unecessary packaging, organic material that could be composted, and paper which could be recycled.

Woodlots

WITH SOUND harvesting techniques, the output of Ontario's woodlots could be increased to provide fuel for the surprisingly large number of Ontario homes heated primarily with wood.

Surplus forests

ONTARIO'S FORESTS contain the equivalent of millions of barrels of unharvested energy. This includes the "leave" — the crowns and branches which are now left on the ground after an area has been logged (a volume equal to 60 per cent of the wood actually removed).

It also includes our surplus forests — those trees which forestry authorities have determined could be harvested, but which are now left standing because they are surplus to the needs of the pulp and paper industry, the construction industry, and other conventional markets. By taking advantage of these surplus forests, Ontario's annual harvest could be increased by more than half.

The wood from the leave and the surplus could be used in the production of liquid fuels such as methanol, which can be blended with gasoline and used in automobiles.

The question here is whether the removal of the leave and the additional harvesting might have a long-term damaging effect on our forest reserves. Certainly forest management would have to be improved over current practices before we could endorse expanded forest biomass harvesting. For one, we would have to be certain that new trees were being planted at least as quickly as the old ones were being cut.

Plantations

MUCH GREATER quantities of energy could be derived by growing wood especially for the purpose, in large tree plantations, on land unsuitable for agriculture.

By using fast growing trees, such as poplar hybrids and red alder hybrids, and by using plantation growing techniques, the yield per acre could be raised considerably above normal forests, making for efficient harvesting.

For the long term it has been estimated that Canada could produce enough energy in this way to replace a third to a half a billion barrels of oil per year (a significant portion of our current consumption of 600 million barrels per year). Like surplus forests, wood from plantations could be used to produce methanol fuel.

Again, however, careful attention must be paid to growing methods. Growing large stands of a single variety could lead to pest and disease problems, and the use of chemical sprays to control these blights is environmentally questionable.

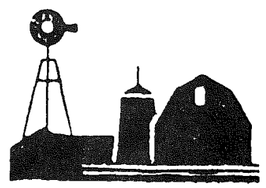
Farm crops

CROPS GROWN on farms could be used in the production of ethanol, another liquid fuel which can be used as a gasoline extender or substitute.

High sugar crops such as sugar beets and fruit are ideal, but it is also possible to use starchy foods such as potatoes, and even treated wood cellulose.

Ethanol is made through fermentation, the same way distilleries make alcohol for human consumption. In fact, the federal government has put barriers in the way of individual ethanol production, presumably because it fears that people would use their ethanol stills to make bootleg liquor. However, the stills could be easily modified so that they could not be used in this way.

One objection to ethanol production based on farm crops is that it would cut into crops used for animal feed. However, this need not be so. The mash residue after ethanol production is actually more nutritious than the original crop, due to the action of the yeast. ■



SOLAR

Energy from the sunshine

OVER A THIRD of Ontario's energy consumption is for low-level heating — space heating and water heating under 100 degrees Centigrade.

The untapped energy of the sun is ideally suited to meet nearly all our low-level heating requirements, and some day solar energy may do just that.

Passive Solar

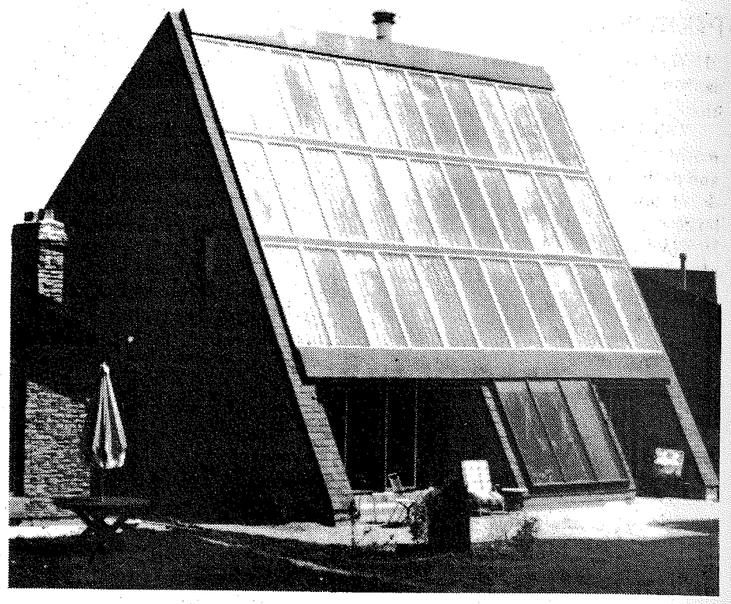
PASSIVE SOLAR provides the most energy for the money. A passive solar building will have large, double-glazed windows facing the sunny south — fitted with shutters or insulated curtains to prevent night time heat loss — and only small windows or none at all on the north. Trees can be planted to provide shade in the summer. In the winter they lose their leaves and allow the sun to stream through.

The passive solar effect can be enhanced by placing some storage medium — barrels of water or building materials containing "phase change" crystals — behind the glass windows. The water or other material absorbs heat during the day and releases it at night.

A well-designed sun room added to a new or existing house can provide significant heat gain.

Passive solar is very cheap and simple, especially when it has been designed into new homes.

It can also be very effective: conservation, passive solar and other measures have cut the heating requirements of Conservation House in Regina to just *four per cent* of what would be required in an average home of the same size.



AN ACTIVE solar home. Solar energy is effective for low-level residential, commercial and industrial heating, despite Ontario's "cold, dark" climate.

Active Solar

ACTIVE SPACE heating systems involve the use of panel-like collectors mounted at the best angle to catch the heat of the sun.

The air or water (or anti-freeze) contained within the collector is heated by the sun and then carried through ducting or pipes to a heat "sink" usually located in the basement. The sink consists of water, stones or some other medium designed to store heat while the sun is shining, and to release it gradually when the sun goes down.

Larger systems are capable of storing heat from one season to the next.

However, the added cost and complexity of an active system — particularly a water-based system — make active solar less attractive than passive. The main difficulty is the large initial installation costs. If individual homeowners were given access to the long-term, low-interest financing available to utilities like Ontario Hydro, the economics of active solar space heating would compare more favourably.

According to the Royal Commission on Electric Power Planning (the Porter Commission), solar hot water heating is now the most economically feasible application for active solar. Other applications will quickly become more appealing to the general public as conventional energy prices rise.

Photovoltaics

PHOTOVOLTAIC CELLS capture sunlight and turn it into electricity.

This is still an expensive method of generating electricty, and at the current stage of development it is not a practical large-scale power source. However, the economics of photovoltaics have been improving rapidly in recently years. As the result of extensive research now underway, this technology may well become competitive with thermal generating plants in the near future.

(Beware of put-downs of solar energy based on cost comparisons between solar electricity and nuclear electricity — photovoltaics is not what we have in mind when we talk about the immediate potential of solar energy.) ■

WIND

Energy from the breeze

TO BE EFFICIENT, wind generators need a strong, steady breeze and unfortunately, there are relatively few areas in Ontario which fill the bill.

As a result, wind generation is unlikely to become a competitive source for large amounts of electricity in this province.

However, it will prove attractive in many individual cases, particularly in remote areas not served by Hydro's electrical grid.

Wind also has been and will continue to be practical for direct mechanical applications, such as pumping water. ■

CONSERVER SOCIETY

A new way of living

THE SHIFT TO energy conservation and renewables could be just one step in the shift to a whole new way of going about things, the Conserver Society.

The Conserver Society would shun all forms of waste and pollution.

Products would be designed to get the most out of scarce resources. Things would be built to last. Unnecessary packaging would be eliminated, and necessary wastes would be re-cycled.

The virtue of automatic growth would be questioned. We would ask: *how much* growth do we want? and *what kinds* of growth do we want?

We would think twice before consuming, especially where non-renewable resources are concerned. This doesn't mean that we would be any less comfortable than we are today — simply that we would learn to enjoy ourselves without indulging in wasteful consumption.

We would feel more secure because we would know how to get by with less, and we would have less reason to worry about running out of everything.

World tensions would decrease. With reduced levels of consumption there would be less competition over scarce energy, food, and raw materials.

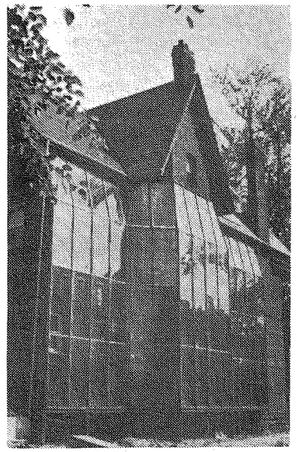
There would also be more to go around, so that the world's under-consuming poor could share in the wealth now being monopolized by the over-consuming rich.

Already many North Americans are finding they can be happier consuming less. In fact, advertising firms are becoming alarmed at the rapidly increasing numbers of potential consumers who have decided to live in "voluntary simplicity".

These people have concluded that the simplest life is the best life, and that the important things are not material goods, but the company of friends, community ties, self-reliance, and personal accomplishments.

These non-consumers have become a real thorn in the side of the corporations, who are finding it more and more difficult to sell them useless and wasteful products.

In the Conserver Society, corporations would have to adapt to the demand for durable, well-crafted, and efficient goods. ■



SIDE VIEW of Pollution Probe's Ecology House, 12 Madison Ave., Toronto. This house has everything, from solar heating to a composting toilet, to a purification system permitting re-use of grey watter in the greenhouse.

UNFAIR DEBATE

Hydro, AECL spend millions on PR

"For little Kael Buck—and for his furry bedmates—the long and lonely journey down the hallway to his parents' room is made less terrifying by his friend, the night light."
Ontario Hydro annual report

ONTARIO HYDRO'S projected 1981 public relations budget is almost $10.5 million, up 17 per cent over 1980. By 1982 the department expects to employ 115 people. That is more than the total number employed by the provincial Ministry of Energy, whose job it is to supervise all aspects of energy policy in this province.

Hydro places television and magazine advertisements. It sends spokesmen on speaking tours to community groups. It arranges educational visits to Pickering. And it sends free materials to the schools, where students are already exposed to pro-nuclear views in their science textbooks.

Hydro's public relations materials convey a number of dubious impressions.

They suggest that nuclear power is safe, cheap, and efficient, that it makes a significant contribution to Ontario's energy requirements, that it is necessary, and that the alternatives are impractical or will take years to develop.

Above all, Ontario Hydro is out to give the impression that it is on the side of the electricity-consuming public — including little Kael and his furry bedmates — while hostile forces attempt to deprive us of that vital electricity.

Atomic Energy of Canada Ltd. is in the pro-nuclear PR business too.

AECL produces a glossy magazine with the inspirational title, *Ascent*. The magazine takes decidedly sarcastic pokes at anyone who expresses an anti-nuclear viewpoint.

AECL is also following Hydro into the schools with an "energy education kit" of its own.

Meanwhile, the public interest groups who are trying to tell the other side of the story are forced to operate on annual budgets which are usually smaller than the cost of a single Hydro television advertisement.

This seems profoundly unfair and undemocratic in spirit. Hydro and AECL are publicly-owned corporations who get their funds from customer revenues and the public purse. Yet governments have generally refused to provide funds to the public interest groups in order to provide for a genuine two-sided debate, and to make certain that the public gets all the facts.

Inadequate public discussion

NOR HAVE GOVERNMENTS provided adequate forums for public discussion and political decision-making about nuclear.

The federal government has refused to initiate a national public inquiry into nuclear power, despite repeated requests from a number of sources that it do so.

The Ontario government did provide one forum, the five-year, $5 million Royal Commission on Electric Power Planning (the Porter Commission).

The Porter Report was remarkably sceptical about the virtues of nuclear, although it stopped short of rejecting this technology altogether. And the report contained many excellent recommendations concerning safety, electricity pricing, and the development of alternative energy sources.

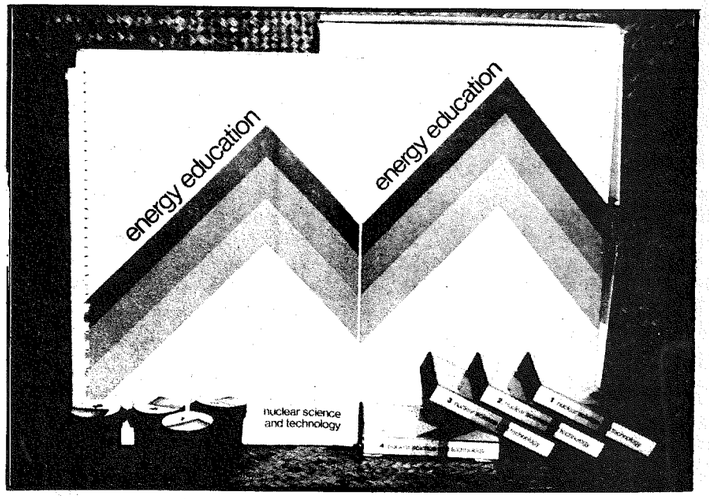
However, the cautioning tone of the report was lost in the ensuing controversy, as were many of the recommendations.

Meanwhile, the provincial government rejected an opportunity for more pointed public debate about the Darlington Nuclear Generating Station by exempting the station from public hearings under the Environmental Assessment Act.

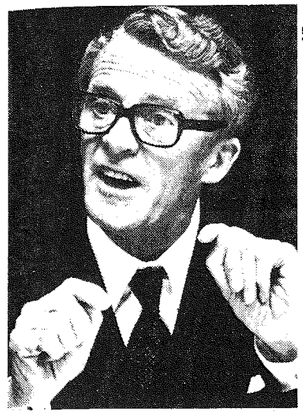
The Ontario government justified the exemption on the grounds that power from the plant was urgently required. However, Darlington was subsequently delayed for three-and-a-half years, and demand projections indicate that we would not suffer if it were delayed further.

This calls into question the good faith of the government in granting the exemption from its own environmental assessment legislation.

The provincial government has also terminated the Select Committee of the Legislature on Hydro Affairs. The Select Committee had acted as a much-needed political watchdog over the activities of Ontario's largest and most powerful crown corporation, Ontario Hydro. ■



HYDRO'S energy education kit, sent free to Ontario schools. The Toronto Safe Energy Group has mounted a campaign demanding that Hydro get out of the energy education business, and that existing pro-nuclear materials in the schools be balanced by materials making the case for a non-nuclear future.



ARTHUR PORTER, chairman of the Royal Commission on Electric Power Planning. Although ultimately pro-nuclear, Porter's report confirmed many of the criticisms levelled by the opponents of nuclear in Ontario.

RECOMMENDATIONS

Some of what needs to be done.

☐ Cancel the Darlington Nuclear Generating Station.

☐ End artificially low energy prices. Provide some form of support to those hardest hit by the increases.

☐ Establish a publicly-owned business to initiate joint venture co-generation projects with industries using process steam.

☐ Set up public hearings to determine the extent of environmentally compatible hydro potential in the province. Develop this potential as needed.

☐ Add scrubbers and other emissions-control measures to all Ontario Hydro coal burning plants. Immediately.

☐ Establish a demonstration fluidized bed coal-burning co-generation plant as soon as possible.

☐ Offer free home audits to advise all homeowners of the best conservation measures. Extend easy-term low-interest loans to all homeowners for the introduction of appropriate conservation measures.

☐ Upgrade energy-conservation requirements in building codes and minimum standards by-laws.

☐ End declining electrical rate structures which give cheaper energy prices to big energy users.

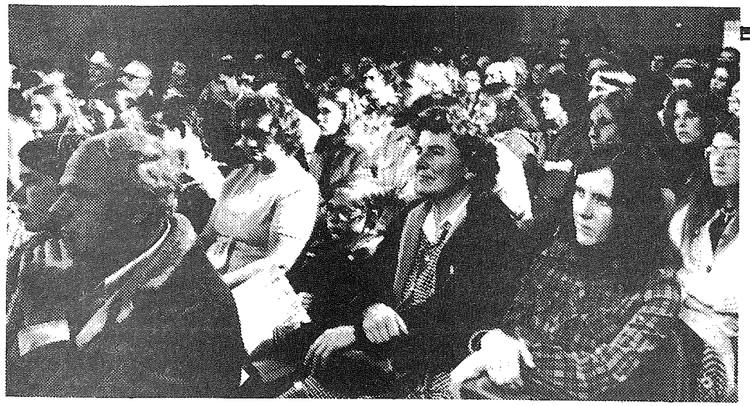
☐ End federal and provincial subsidies for conversions to electrical resistance home heating.

☐ Develop a long-term plan to phase out all nuclear power in Ontario and to replace it with environmentally-compatible energy sources.

☐ Establish a new independent agency to be responsible for all forms of nuclear waste, from mine tailings through to spent fuel.

☐ End all subsidies to the nuclear industry; cease efforts to promote CANDU exports. Develop a plan to find jobs for the displaced workers.

☐ Curb pro-nuclear public relations efforts by Hydro, AECL and others, especially in the schools. ■



SAFE ENERGY GROUPS

How to get involved

MANY WELL-KNOWN public figures and organizations have expressed concern about at least some aspect of nuclear power.

These include authors such as Pierre Berton and Farley Mowat, rock stars such as Jackson Browne and Bonnie Raitt, and actors such as Donald Sutherland and Don Franks.

Canadian labour organizations have passed various resolutions demanding increased emphasis by governments on conservation; some of these resolutions have contained specific references to the need for funding alternatives to nuclear power.

The Stockholm International Peace Research Institute has come out against nuclear due to the connection with nuclear arms.

The federal New Democratic Party has adopted a policy calling for an end to the Canadian nuclear industry.

Numerous church organizations have expressed reservations or opposition to nuclear, and the Canadian Medical Association has called for a nuclear moratorium until a safe waste disposal method is found.

IF YOU ARE concerned about nuclear power and would like to see conservation and alternative sources get their due, you may want to get involved with one of a number of groups who are promoting a safe, sane energy future for Ontario.

These groups conduct research, publish and distribute materials, educate the public, and lobby for changes in government policies. Here is a partial list:

- *OPIRG-Peterborough/Birch Bark Alliance.* Trent University, Peterborough, K9J 7B8, (705) 748-1554 .
- *OPIRG-Provincial,* 214 Blackwood Hall, University of Guelph, Guelph, (519) 824-2091.
- *Temiskaming Environmental Action Committee*, Terry Graves, General Delivery, New Liskeard.
- *Renfrew County Coaltion for Nuclear Responsibility*, c/o Tony Cowan, R R 4 Killaloe, (613) 756-6481.
- *Energy Probe - Ottawa*, David Brooks, 53 Queen St., Station B, Ottawa, (613) 233-0260
- *Physicians for Social Responsibility,* Dr. Frank Sommers, 360 Bloor St. W., Suite 406, Toronto, M5S 1X1, (416) 922-7335.
- *Friends of the Earth,* Ralph Torrie, 53 Queen St., Ottawa, (613) 235-3860.
- *Canadian Coalition for Nuclear Responsibility*, 2185 Decarie Blvd., Montreal, P.Q., (514) 842-1471.
- *Leeds County Conserver Society*, Emily Finn, R R 1 Mallorytown, (613) 923-5783.
- *PANDA*, Bill Borger, R R 1 Brockville, (613) 348-3788.
- *Kingston Coalition for Nuclear Responsibility,* Stan Segal, 46 William St., Kingston, (613) 544-0060.
- *SEAP*, Pat Lawson, R R 1 Port Hope, (416) 885-5396.
- *Energy Probe - Toronto*, 43 Queen's Park Cres., Toronto, (416) 987-7014.
- *U of T Anti-Nuclear Group (UTANG),* Colleen Heffren, 199 Concord Ave., Toronto, M6H 2P2, (416) 537-3646.
- *Toronto Safe Energy Group*, Tim Grant, 95 Roberts St., Toronto, (416) 960-1244.
- *THINK*, Dave Assman, 272 Erb St. Waterloo, M2L 1W2, (519) 752-1300.
- *London Safe Energy Coalition* G. Burgess, 563 Oxford St. E., (519) 439-9388.
- *Downwind Alliance*, c/o OPIRG Windsor, 824 Tecumseh Rd. E., Windsor.
- *CANTDU (Huron Shore)*, Tony McQuail, R R 1 Lucknow, (519) 528-6542.
- *Algoma Manitoulin Nuclear Awareness,* Ed Burt, R R 1 Gore Bay, Manitoulin Island. (705) 282-2886.
- *Algoma Committee for Nuclear Responsibility*, Sharon Belisle, Box 594, Thessalon, Norm Sloan, 305 Pim St., Sault Ste. Marie (705) 256-5222.
- *Atikokan Committee for Nuclear Responsibility*, Box 804, Atikokan.
- *Solar Energy Society of Canada Inc.*, many local groups. Get names and addresses through the national office, Suite 303, 870 Cambridge St., Winnepeg, Manitoba, R3M 3H5.

FURTHER READING

Want to know more?

CANDU? A Review of Performance Cost and Safety.
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a 40-minute slide-tape show by Paul McKay. Available for $70 (purchase) or $10 (rental) through OPIRG-Peterborough, c/o Trent University, K9J 7B8, (705) 748-1554.

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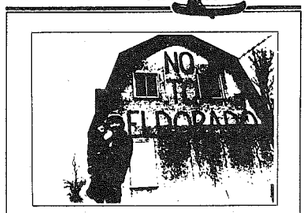
two pamphlets by the Toronto Safe Energy Group. For copies, write TSEG c/o 95 Robert St., Toronto, M5S 2K5, 536-1243.

Ontario's Voice of Nuclear Concern
The Birch Bark Alliance



"There's a hell of a movement going on up here"
Report from Blind River

Cartel Blanche: Uranium price fixing
No CANDU to Korea
Electric heating? Forget it.

The Birch Bark Alliance
quarterly news about nuclear in Ontario. $6 for two years ($8 for institutions and organizations). Bulk $20/100 copies. Write c/o OPIRG, Trent University, Peterborough, Ontario, K9J 7B8

Canadian Renewable Energy News
monthly. $14 a year; $25 for two years. Pay to CREN Publishing Ltd., P.O. Box 4869, Stn. E. Ottawa, K1S 5J1

GLOSSARY

Atomic Energy of Canada Ltd.—a federal crown corporation which conducts research and development on CANDU reactors, and which is responsible for promoting domestic and foreign sales of Canadian nuclear technology. AECL is also responsible for developing a safe reactor waste disposal method in Canada.

Atomic Energy Control Board—a federal agency responsible for nuclear safety standards and the licensing of nuclear stations and refineries.

Loss of Coolant Accident (LOCA)—a blockage or leak which causes the flow of heavy water surrounding the reactor core to be seriously reduced. Dangerous over-heating may result.

Fuel failure—a reactor accident in which the reactor core over-heats, causing the metal alloy fuel sheathing to rupture. Fuel failure stops short of actual melting of the fuel itself. Dangerous radioactive gases may be produced.

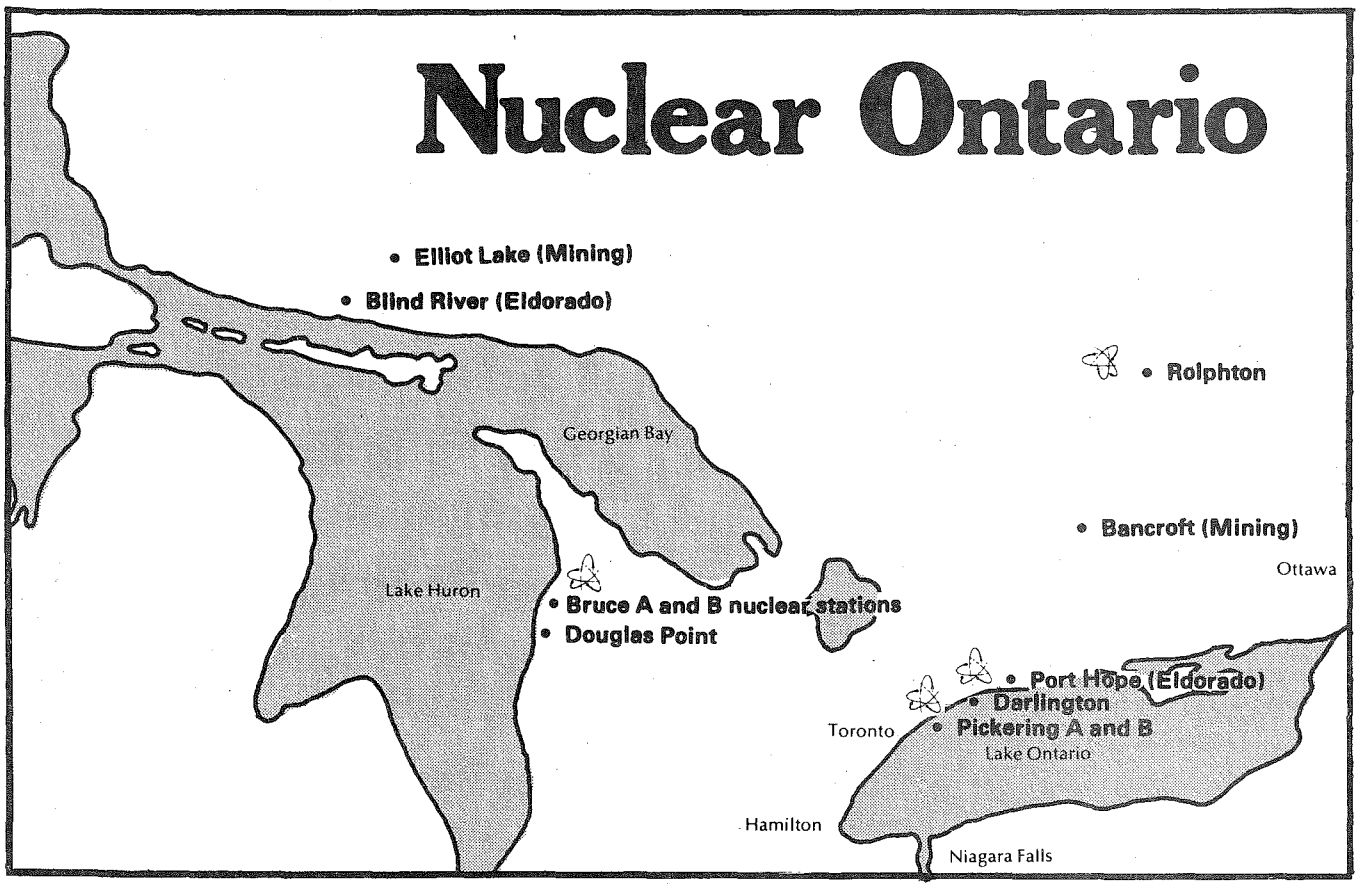
Meltdown—also known as the China Syndrome. Extreme over-heating of the reactor core causes melting of the fuel bundles. Fuel may melt through the floor of the reactor building. Releases of radioactive gases into the atmosphere are very likely to occur.

CANDU—stands for CANadian Deuterium Uranium. CANDU is the reactor design developed in Canada. Its distinguishing features are the use of deuterium (heavy water) as a reactor core coolant, and the use of natural uranium (as opposed to enriched uranium) as a fuel.

Emergency Core Cooling System (ECCS)—in the event of an interuption in the normal flow of coolant around the reactor core, this safety system is designed to keep the core bathed with coolant.

Containment system—in the event of a reactor accident resulting in the production of radioactive gases, this safety system is designed to prevent the release of these gases into the atmosphere.

Nuclear Ontario



	Megawatts	In Service Date	Lifetime capacity factor	Cost ($millions)
Rolphton	22	1962	61.6%	33
Douglas Point	206	1968	45.6%	85
Pickering A	4 x 516	1971-73	78.5%	746
Bruce A	4 x 750	1977-79	69.7%	1900
Pickering B	5	1983-85		3115
Bruce B	4 x 750	1983-87		4522
Darlington	4 x 875	1988-91		6640

THE CAPACITY factors refer to the percentage of maximum potential output acheived by each station since it began service. CANDU stations are meant to achieve a target capacity factor of 80 per cent, but shutdowns and slowdowns have kept capacity factors well below that level in every station but Pickering A. These factors will be driven down much further by re-tubing operations at Douglas Point, Pickering A and (eventually) Bruce A. The pressure tubes which hold the fuel rods in the reactor core have expanded more than expected and they will have to be replaced—an expensive, time-consuming operation which will keep each reactor out of operation for at least a year.

Delays and cost-overruns are also a common feature of Ontario's nuclear programme. Pickering B, for example, has been seriously delayed because 38 of the plant's 48 boilers were found to be defective. The boilers will have to be repaired at an estimated cost of $35 million, most of which will have to be borne by Hydro ratepayers.

The total of all cost over-runs for Ontario's nuclear stations now stands at $6.5 billion. This figure includes the difference between original estimates and actual costs and, in the case of reactors now under construction, the difference between original estimates and current estimates.

SOURCE: CANDU? A Review of Performance, Cost, and Safety.