CITY OF TORONTO

MARILYN CHURLEY
City Councillor - Ward 8
City Hall, Toronto, Ontario M5H 2N2

TEA
TORONTO
ENVIRONMENTAL
ALLIANCE

June 21, 1989

Dear Friend:

Environmentalists Plan Toronto has been going very well. Our last meeting was on Transportation and it was very successful.

Our next meeting will be on Energy, including conservation strategies, alternative sources and cleaner use. Hope to see you there.

EPT's ENERGY MEETING WILL BE HELD ON
WEDNESDAY, JULY 5th, at 7:00
IN COMMITTEE ROOM #5
2nd FLOOR, CITY HALL

We've enclosed some background material for you to look at before the meeting.

Sincerely,

M Churley
Marilyn Churley
Councillor - Ward 8
sm063d02

Don Houston
Don Houston
TEA

ENERGY QUESTIONS:

1. Who is going to require the energy?

2. How much energy?

3. What kind of energy?

4. For what purpose?

5. For how long?

Areas to examine:

1(a) Government, Personal, Business

2(a) Consumption patterns; now and projected.

3(a) Renewable energy sources, existing energy sources

4(a) Transportation, heating, lighting, other uses

5(a) Need for energy in the future, projections.

"The basic tenet of high-energy projections is that the more energy we use, the better off we are. But how much energy we use to accomplish our social goals could instead be considered a measure less of our success than of our failure" -Amory B. Lovins <u>Soft Energy Paths</u>

FACTS ON ENERGY CONSERVATION

"Energy is cheap and plentiful." This was the attitude of Canadians for many years, and it is still reflected in our energy management. Government and industry have done their part to encourage high consumption rates — not long ago we were being told to "live better electrically" and to buy bigger, inefficient automobiles. Few people were concerned about inefficiency, and before the oil embargo of 1973, conservation was almost completely ignored in most Canadian energy plans.

Energy use in Canada grew at a high rate of 6.3% per year between 1962 and 1972. At that rate, the amount of energy used by Canadians doubles in 11 years. Between 1974 and 1975, growth in energy consumption dropped dramatically — to 0.6%, because of higher prices, an economic recession, and conservation measures.

Historical and Projected Energy Growth Rates
(percent per year)

Historical:	Primary	Secondary
1. 1945 - 1970	4.5	
2. 1962 - 1972	6.3	5.6
3. 1974 - 1975	0.6	-0.3
Conservation Strategies:		
1. Federal Office of Energy Conservation report	2.1	1.4
2. Zero energy growth per capita	1.3	0.8 (?)
3. Zero absolute energy growth	0.0	0.5 (?)

Primary energy is all energy produced. Secondary energy is energy as purchased by consumers (primary energy minus losses and minus energy used to make plastics, fertilizers, etc.)

Adapted from: "A Real Option: Conservation to 1990 and Beyond" by Dr. David Brooks, 1977.

Nevertheless, Canada still uses more energy per person than any other country. A Canadian uses about twice as much energy as a person in West Germany or Britain, three times as much as a person in Japan, and one-and-one-half as much as a person in Sweden.

This does not mean that our standard of living is the highest in the world. In fact, per capita income in Canada in 1978 was about the same as in Sweden.

How We Use Our Energy

The energy chart below shows how we used energy in 1960 and 1974. The sector in which energy use has grown the fastest is the commercial sector (offices, schools, stores, hospitals, warehouses and a variety of other buildings).

An energy conservation strategy simply means using our energy resources more wisely. If we pare the amount of energy needed in each of the sectors we can do as much as we do today, but use less energy. Conservation can stretch the earth's limited stock of fossil fuels, permitting us to shift to renewable resources.

CANADIAN ENERGY CONSUMPTION
(in trillions of BTU's)

	1960 BTU	1974 BTU
Domestic and farm	714	1176
Commercial	247	768
Industrial	1001	2004
Transportation	746	1518
Energy supply	212	471
Total BTU's (10^{12})	2920	5937

(This is energy finally consumed by the user and does not include energy lost in converting fossil fuels to electricity in thermal electrical plants.) Total energy demand grew by 5.5% (about 350 x 10^{12} BTUs) in 1974. In 1975, there was almost no growth.

- taken from Energy, Mines & Resources Canada.

Quality Distribution of the Energy Consumed in Canada (1969)

Details		Energy Consumed
Liquid fuels for transportation		24.8%
Necessary electric		13.9
Heat		55.4
(Space heating	31.8)	
(Low temp: 100 - 140 C	11.9)	
(Int. temp: 140 - 260 C	6.6)	
(High temp: over 260 C	4.9)	
Other		5.8
TOTAL		99.9%

(adapted from "Temperature Distribution of the Energy Consumed as Heat in Canada", V.R. Puttagunta, AECL, 1975)

Conservation in the Residential Sector

Housing is a major energy consumer, responsible for about 20% of our Canadian energy budget. Governments and municipal utilities could reduce the amount of energy for housing, through proper urban planning, district heating, incentives for developers to build energy efficient housing, and efficiency standards for appliances. It isn't just a matter of individuals adding insulation.

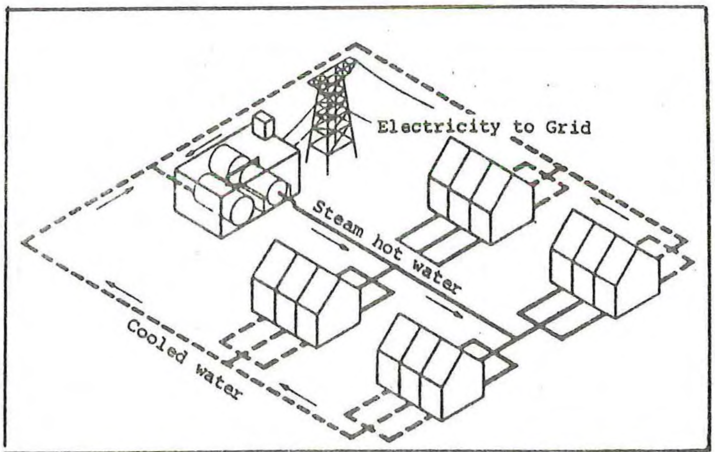
1. Urban planning. Urban sprawl wastes energy. Cluster housing and multiple unit housing is more energy efficient because of smaller surface areas and central heating furnaces. Apartments use about half the energy for space heating that single family homes use; townhouses use about three quarters the energy of single family homes.

Street design giving buildings north-south faces can enable builders to take advantage of heat from the sun.

Land use planning provides opportunities to save energy and reduces some other costs. The cost per house of roads and utility services (sewers, electricity) is less in medium density housing than in "sprawl" housing (typical suburbia).

2. District heating in urban areas: District heating is one way of providing energy from a central source to houses. Instead of each home producing its own heat in its own furnace, one large furnace can take care of the heating needs of many homes. At the same time, the furnace can generate some electricity. Oil, gas, wood, and garbage can be used to supply district heat. Waste heat from conventional electricity generation plants can also be used.

As shown below, hot water or steam produced by a wood burning furnace is piped underground to each home, where it can be used for space and water heating. The cooled water then returns to the furnace for reheating.



WOOD BURNING ELECTRICAL GENERATION AND DISTRICT HEATING from: Appropriate Technology, Bruce McCallum, 1976.

District heating saves energy because of its higher efficiency, and protects the environment because each house no longer emits pollution from individual chimneys.

According to a study for the Ontario Ministry of Energy, fossil fuelled district heating shows an overall price advantage over individual heating in eight to thirteen years for a new town of 70,000. Another study concludes that new towns as small as 2,300 people could use district heating economically, assuming a payback period of 30 years and an interest rate of 9%.

District heating is used in 90% of the medium sized towns in Sweden and Denmark. It is a well-known energy-saver in Europe.

3. Building design: 80% or more of the energy used in homes can be saved by building a house the right way, to minimize heat loss in winter and heat gain in summer. Well-designed homes have the following characteristics:

- They are compact, and have minimal wall and roof areas.
- They do not have north windows.
- They use garages as buffers on the sides of the house where prevailing winds occur.
- They minimize heat gain in summer with shading deciduous trees and overhang devices.
- They use heat traps such as solar greenhouses and large fireplaces.
- They use heat exchangers. In a typical house inside air is replaced by outside air every two hours, and during the winter this air must be heated. Heat exchangers work by warming up the incoming cold air with outgoing hot stale air. They collect hot air and blow it out through one channel which will warm the fresh air coming in another channel. In the model Conservation House in Saskatchewan, exchangers recapture 50-70% of the heat in vented air.
- They have tight-fitting doors and windows.
- They maximize solar gain in the winter with windows on the south. Double glazed and triple glazed windows also cut down on the rate of heat loss at night and on cloudy days.
- They use insulated shutters at night in winter.

Some homes make use of one of the best insulators around — earth. Living underground does not mean living in complete darkness. Both fully and semi-submerged underground houses are designed to let sun in.

<u>Saskatchewan Conservation House: an Energy Efficient Building Design</u>

This efficiently-designed house requires less than 4% of the heat energy used in an average Regina house of the same size. Major conservation features include house orientation, efficient vapour barriers, insulating shutters, heat exchangers and high insulation levels (walls R-40, ceiling R-60). 84% of the house's required space heat comes from passive solar gain (43.5%), lights and appliances (33.5%) and occupants (7%).

The following estimates of the costs of energy conservation have been made for new houses in Saskatchewan conditions:

Conservation feature	Additional cost	Energy saved (million Btu)	$ saved on energy bills
Orientation	$ 0	25.5	$175/yr
Caulk & seal vapour barrier	400	18.1	124
Insulating shutters	450	13.0	89
Heat exchangers	300	5.1	35
Insulation levels same as Saskatchewan House	2000	11.4	78

4. Energy-Efficient Appliances: There are at present no legally enforceable efficiency standards for appliances in Canada. The U.S. Federal Energy Agency did a study of appliance energy efficiency which concluded that most large appliances could be improved significantly. Freezers, for example, could be three times as efficient as present-day average freezers, and televisions could be twice as efficient.

Ripple and Audio Control Devices

These are simple devices that utilities can install in residences. Presently utilities provide us with energy on demand. However, the overall demand for electricity rises and falls at different times of the day. Household appliances such as stoves and heaters are used by many homeowners at the same time and place a great demand for electricity, so "peaks" occur — early in the morning, and in the afternoon from four to seven o'clock. When this happens, the utilities must use their most expensive generating plants. This means more expensive electricity.

For many years now Europeans have solved this problem with ripple control. The manner in which it works is simple. A signal is sent through the power lines from the utility company to switch certain appliances off during a "peak" period. Usually the appliance is a hot water heater, and the homeowner does not even miss the heater because of the two hour storage capacity most have.

Radio control works in much the same manner as ripple control, except that its signal is sent across the air waves. A little black box the size of a calculator is installed in each home to receive messages sent to the control devices. Presently the cost for these devices is about 1/10 the cost of providing electricity with new capacity.

People who have ripple control devices should be rewarded with lower electricity rates: they save the utility money.

Fixing Up Existing Homes

About 50% of the existing homes will still be around in the year 2000. The following techniques can be incorporated into new and old homes.

1. Insulation: The average Canadian wood frame house is said to be about the most upgradeable in the world. Insulation can save up to 40% of the energy used for space heating at prices which pay off in five years, according to the federal Office of Energy Conservation.

Four basic insulating materials are on the market: cellulose, polyurethane, fiberglass and rock wool. For a complete description of home insulation read *Keeping the Heat In,* from Energy, Mines & Resources, 580 Booth St., Ottawa, Ontario.

2. Individual Hot Water Heaters: These improve the efficiency of supplying hot water, by providing warm water when and where it is needed. Presently Canadian homes have central hot water heaters which keep warm water stored for use at any time. In 1974 water heating was responsible for 7% of residential energy use.

Individual heaters can be located near appliances to produce warm water when needed. A small 7.5 gallon heater can serve bathtubs and showers and operate on demand with a five minute start-up time. Some types have timing controls to automatically switch on and off. These systems can save up to 10% of domestic hot water energy needs.

3. Heat pumps: Heat pumps work by extracting energy from outside air and delivering it inside. A liquid under compression is allowed to expand and become a gas (taking in energy) in a cold area (in contact with the outdoors). Then the gas flows to another area (inside) where it is compressed (giving off energy), thus heating the building.

Heat pumps are attractive because under favourable conditions only a small amount of electricity (1 kilowatt) is consumed to provide up to four kilowatts of energy in the home. Also, in the summer they can operate as air conditioners by reversing the heat flow. However, they are least efficient in winter, when it is coldest outside; and they are costly.

4. Energy from household waste: A domestic waste water heat recovery unit serves the same purpose as heat exchangers, by recapturing energy. Most of us are guilty of wasting energy when we pull the plug for bath, shower and laundry water. If used hot water circulated from these sources to a heat recovery unit, it could preheat incoming cold water before it entered the domestic hot water systems.

5. Energy-saving thermostats: Automatic thermostats that can be set for two different temperatures can turn down the heat in a home at night and turn it back up in the morning. Homeowners with automatic thermostats set to switch from 68 to 55 degrees might expect to save $15 for every $100 they now spend on fuel. The advantage of these thermostats is that people can wake up in warm homes. They also come equipped with various adjustments for irregular lifestyles.

6. Small but important changes: These tips can save money and energy in the home:

- Setting the thermostat to 68° in winter instead of 72° can save almost 10% on fuel bills.
- Turning off leaky taps is a money saver. A drip per second from a tap can lose up to 175 gallons a month.

Weatherstripping around doors and windows can avoid heat leaks.

For other tips, write for *100 Ways to Save Energy and Money in the Home* and the *Garbage Book*, from Energy, Mines & Resources, 580 Booth St., Ottawa, Ontario.

Conservation in Transportation

Due to the high degree of mobility of Canadians, and the inefficiency of our transportation system, 25% of the energy Canadians use goes to transport people and goods. Almost all of this energy comes from oil. In fact, more oil is used for the transportation sector than for any other sector of the economy.

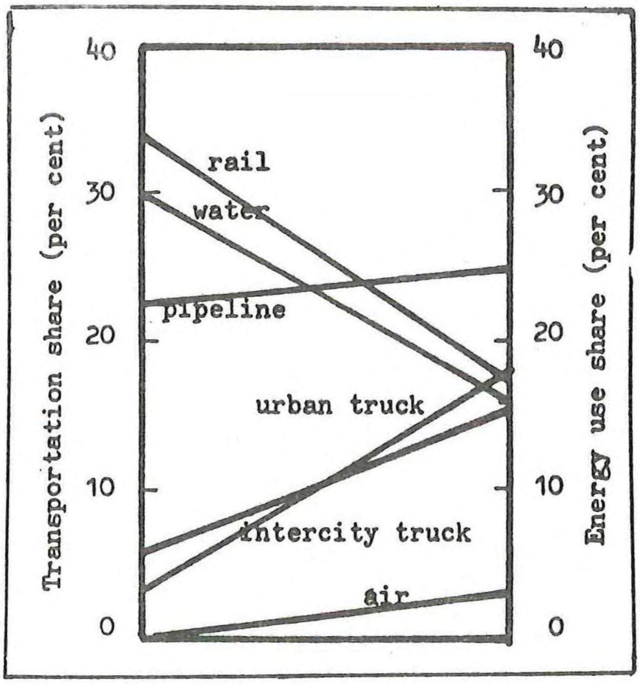
Transportation efficiency measures the amount of fuel used per unit of transportation. The following chart shows the efficiencies of various transportation options in terms of the amount of energy used (expressed in British Thermal Units) to transport a passenger one mile (or a ton of freight one mile).

Energy Intensity of Transportation Modes (1970)

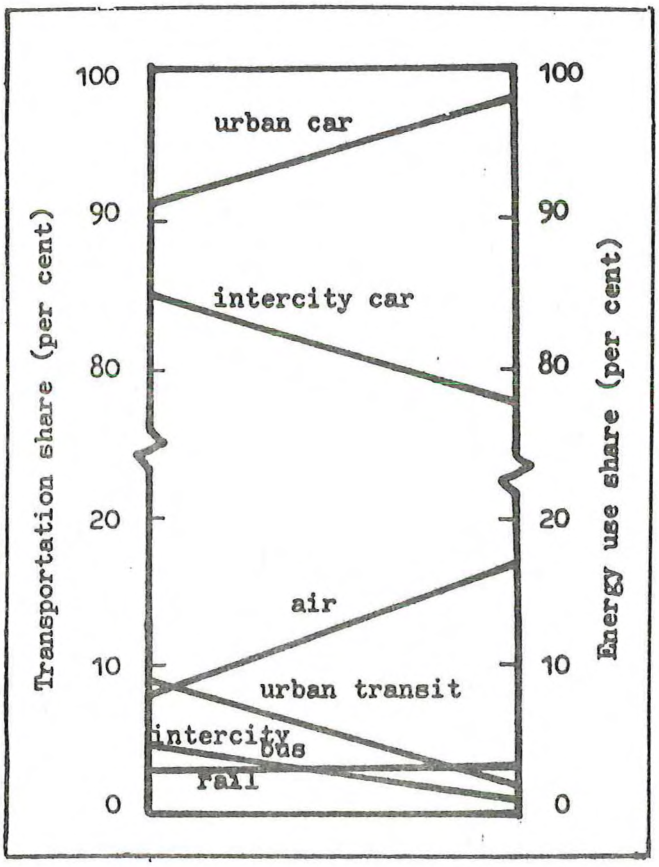
Mode		Energy Intensity (Btu/passenger mile or Btu/ton mile)	
Car	(urban)	7,750*	(9870)**
	(intercity)	3,240	(3030)
Bus	(urban)	1,650	(1575)
	(intercity)	970	(860)
Rail	(passenger)	4,370	(4500)
	(freight)	560	(560)
Truck	(urban)	7,000	(6700)
	(intercity)	2,500	(4475)
Air	(passenger)	8,240	(8280)
	(freight)	41,200	
Marine	(freight)		(540)

* Figures from Energy Research Group, Carleton University (October 1974)
** Figures developed by Resourcecon.
Figures based on actual occupancy.

As the graphs below demonstrate, the more efficient freight transportation modes are the most frequently used. However, in passenger transportation, the most heavily used mode (the car) is the *least* energy-efficient. This is true for both urban and inter-city transportation.



Comparison of transportation output and energy use for freight modes in 1970.



Comparison of transportation output and energy use for passenger modes in 1970.
from Kenneth Ziebartn, 1976.

Transportation energy can be reduced through:

- Technical improvements, which can result in efficienc... transport systems of as much as 100%.
- "Load factor improvements" (increasing the numbe... people in the same vehicle): a half empty airplane and an automobile with only one passenger are less efficient at transporting people than fully laden vehicles.
- "Modal shifts" (shifting travel from one form to another — for example, from cars to buses).
- Land use planning: urban sprawl and centralized downtown business sections in cities encourage excessive dependence on inefficient forms of transportation.

The Car

The car accounts for more than 50% of total transport energy use. This energy is used up at rates of anywhere from 5 miles per gallon of gasoline (mpg) to 50 mpg. A 50% improvement in the overall fleet efficiency of Canadian automobiles would result in savings of close to 15,000 barrels of crude oil per day.

Fuel efficiency standards announced (but not mandated) by the federal government are designed to achieve a minimum fleet average of each manufacturer and importer of cars used in Canada of 24 mpg by 1980 and 33 mpg by 1985. This represents a significant improvement over 1975 fleet averages of 17.5 mpg, and will result in a lower level of gasoline consumption in 1985 than in 1975, even if the number of automobiles grows at 3% per year. The standards are easily attainable, and could be made more stringent. The 1978 diesel Rabbit is rated at 53 mpg.

Fuel efficiency can be increased through improved combustion in engines, radial tires, lighter construction materials, improved aerodynamic design, and reduced size, as well as other design changes.

Good car maintenance and driving style can also reduce automobile energy consumption. Spark plug misfiring, for example, causes an 8% rise in fuel consumption. Driving at 70 instead of 55 mph causes a 20% rise in consumption. *The Car Mileage Book*, by the Office of Energy Conservation, has information for the car owner on conserving. (580 Booth St., Ottawa, Ont.)

Public Transit Systems

If the load factors of transit systems are improved, the efficiency rises accordingly. A study of Eglinton Avenue in Toronto indicates average all-day load factor of buses over the total length of the route is about 27%. The peak load factor is about 51%. These high load factors result from two major employment concentrations and several minor employment concentrations along the route. Suburban bus routes experience significantly lower load factors. Proper land use planning is crucial for an efficient transit system.

Modern technology can be used to improve levels of service of transit systems through such advancements as computer-run telephone services which tell transit riders when the next bus will be at their stop, thus eliminating long waiting times at bus stops. One such system is now being tested in Mississauga, Ontario.

Other means of encouraging transit use include:

- lanes reserved for transit vehicles only.
- staggered work hours.
- increased parking costs
- costs of road building and maintenance charged to automobile users directly (as in tolls), rather than through taxes.

Car Pooling

Car pooling and van pooling save energy, but are sometimes hampered by scheduling difficulties, personal compatibility problems, and cost sharing and liability problems. Creative use of car pooling could reduce the need for off-peak public transit and provide better service.

Conservation in the Commercial Sector

Included in this sector are offices, schools, stores, hospitals, warehouses, and a variety of other buildings. More than 12% of the energy pie in 1975 went towards these buildings' energy requiremen-ts.

Large Office Buildings

One would think that an average city office building would spend much of its energy heating itself, but in fact lights, equipment, and people give off large amounts of heat. As a result, much of the energy used by large buildings is for cooling — even in winter.

We can prevent this inefficiency in new buildings. In Toronto a well-designed building — the Ontario Hydro building — uses 1/3 of the energy conventional office towers do, because it was constructed with energy savings in mind. However, it cost no more to build than do inefficient buildings. Three main principles guided the design:

- Material consumption is energy consumption.
- Inefficient space is energy wasted.
- Heat generated in buildings from lights, machines and people can be used instead of wasted.

The Ontario Hydro building picks up "waste" heat on each floor with a forced air circulation system. This takes the air to the roof of the building to be cooled down by chillers (part of the air conditioning system); the energy is stored in a 1.6 million gallon water tank. This tank serves as an energy " bank" for night and weekend use.

In the summer the building also needs to be cooled so heat is taken from equipment but just dispelled into the atmosphere.

The energy storage bank means that less expensive technological equipment is needed and that electrical costs are cut considerably because of the reduced need for an air conditioning system.

The northeast positioning of the building means less sunlight can penetrate into the windows and cause a heat problem. Double glazed windows are covered with reflective tinted glass and are capable of preventing 80% of the sun's rays from entering office rooms. In the winter the tinted dual glazed windows act to reflect heat generated by people and machines, back into the rooms.

Even an innovative approach to the lighting system has meant considerable savings in electricity bills.

Improving Existing Buildings

To stop heat gain:

- Insulate and seal cracks.
- Use tinted glass or reflective film coats on south facing windows to keep out solar heat.
- Use overhangs or natural vegetation to reduce radiation in summer.
- Use roof cooling sprinkler systems, which are perfect for cooling warehouse rooftops. In some cases these cooling mechanisms have cut down the amount of heat gained through a roof by 10%.

To stop heat loss:

- Use heavy curtains or shutters at night.
- Use doors where possible around loading dock areas.
- Construct entrances and vestibules to cut down on air infiltration.
- Use double glazed windows.
- Eliminate skylights.

Ventilation systems: Presently ventilation standards are exceeded in many buildings. By reducing the amount of air changes in a building to a minimum rate, less energy is consumed and the quality is not necessarily affected at all.

Lighting systems: The typical incandescent light bulb is an example of an inefficient light source — it produces only 10% light, and 90% heat. One 40 watt fluorescent lamp provides more lignt than three 60 watt incandescent bulbs.

In many buildings lighting levels are well above what is needed, and many areas are unnecessarily lit. Task lighting (lighting certain areas where tasks are carried out) can save energy without discomfort, by providing extra light where it is needed, leaving other areas at lower lighting levels.

Ceiling fans: These are an inexpensive way of solving "heat stratification" in warehouses. This problem arises during winter, when hot air rises to the ceiling, causing as muchas a 20% difference between the floor and ceiling. Large fans can push the wasted heat down, raising the temperature of the warehouse without turning up the thermostat. Some warehouses have found it possible to save up to 15% of heating bills, with fans.

According to Energy, Mines & Resources, a 91,640 sq. ft. warehouse that installed 47 ceiling fans (at an operating cost of $375 per year) reduced heat demands and saved $2,500 in just one year. Total cost of the fans could be paid off in just five years.

Computer monitors: Computerized energy automation centres can be programmed to turn equipment off when it is not needed. One such centre at the Sheraton Hotel in Toronto is programmed according to occupancy in the hotel, so that when occupancy is down, lighting and heating are shut or lowered. The centre saves $110,000 per year, but only cost $200,000.

District heating and heat exchangers: These systems can also be adapted for the commercial sector.

<u>Quality Distribution of the Energy Consumed in the Commercial Sector</u>

Necessary electric (lights, machines)	13.1%
Mobile equipment	3.3%
Space heating & air conditioning	83.5
Total	99.9%

The above chart indicates the greatest energy savings are to be found in space heating and air conditioning.

Conservation in Industry

The largest gains to be made in conservation are in the industrial sector. Canada's primary (e.g. mining) and secondary (manufacturing) industries account for almost 33% of total energy consumption. Five manufacturing groups (primary metals, chemicals, paper, petroleum products and food and beverage products) consume over 50% of all industrial energy. These industries are more than five times as energy intensive as the rest of the manufacturing sector.

Energy conservation means using energy more efficiently. It does not necessarily mean a reduction in production or a curtailment of economic growth. Energy and money can be saved by very simple "housekeeping" tasks such as insulating pipes, reducing lighting levels and turning off unused machinery, and through well-known technologies such as recycling of heat and waste materials, "cogeneration", and improved motor design.

A brief look at some techniques suggests the potential for simple changes:

- At a General Motors van plant, an hour elapsed between the two shifts, during which time the plant machinery was left on. By simply reorganizing the schedule so that the shifts were butted together, energy savings of 35 million BTU were realized, and $70,000 were saved.
- International Harvester's Hamilton plant realized annual savings of more than $19,000 after an investment of $2,700 in repairing leaks in compressed air lines throughout the factory.
- By using a comprehensive steam trap maintenance program, Dominion Foundries and Steel Ltd. were able to save $285,000 in annual energy costs for only $25,000 in maintenance costs per year.
- Insulation of a large corrugated asbestos siding wall at the Canadair plant in Montreal resulted in savings of 36,000 gallons of fuel oil. The insulation cost $22,000; the cost will be recouped in two years.

Heat exchangers: At present, much of the heat generated in the industrial sector is exhausted through large stacks and chimneys, or through pipes to sewers. Air-to-air heat exchangers can reduce heating costs by preheating incoming air with hot exhaust air. Similarly, energy consumption for water heating can be reduced by extracting heat from outlet fluids and reusing the heat for incoming water.

- George Weston Ltd., a Toronto bakery, saved $5,300 per year by installing exchangers to capture waste heat from flue gases to preheat oven air. The cost of the improvement: $7,250.
- A manufacturer of asphalt roofing recovered heat from flue gases from an incinerator originally designed to dispose of asphalt-air. The equipment cost $37,000, and resulted in $45,000 per year in saved heating costs.

Recycling: While some materials such as copper, iron and steel have been recycled for years, it is only recently that industry has begun to recycle paper, glass and fossil fuels. Recycling cuts down on the need for continued production of raw materials, reduces the volumes of waste we must deal with, and usually contributes to reduction in pollution.

- Chem-Ecol Ltd. recycles over 1 million gallons of waste oil per year, and returns it to oil companies at one-half to two-thirds the cost of new oil.

Cogeneration: This is the combined production of industrial process steam and electricity at the same time. This technology, widely used in Europe, increases the amount of useful energy obtained from fuel. In a typical situation steam would be produced in a high pressure boiler or furnace; it would be used to turn a turbine to generate some electricity, and then go on to be used in an industrial process. Cogeneration offers energy savings of up to 30%.

Forest Industries

Within the industrial sector the largest potential is probably in the forest products industries. These are the single largest consumers of energy in Canada. Some firms have made moves towards energy self sufficiency by using waste-log fuel (bark, chips, sawdust) as a major fuel source. Combustion of these wood wastes for the production of process steam and electricity can greatly reduce dependence upon oil. Pulp and paper industries now account for 6% of total energy consumption but with full use of wastes they could produce more energy than they consume.

What Need to be Done

- The pricing of energy should reflect the rising costs of developing new supplies of frontier oil and gas and of building new electrical generating facilities. Marginal cost pricing — pricing of energy to account for increasing costs of new sources — will induce greater conservation.
- Electrical utilities should actively promote the co-generation of electricity by large industrial concerns, as a means of producing additional electricity.
- Incentives to promote greater energy efficiency through tax credits, sales tax reductions and research and development should be strengthened.
- Transportation options should reflect the energy intensity of each mode through the pricing structure and the more efficient systems should be subsidized by monies raised from less efficient transport options.
- Car use in urban areas should be discouraged with a corresponding improvement in public transit. Parking rates in downtown areas should be raised with additional monies being devoted to assist public transit.
- Lanes for public transit and preferred access to downtown shopping areas would enhance the role of transit.
- Standards for energy efficiency of automobiles should be made mandatory and should be broadened to include all transport modes.
- Building codes should be greatly strengthened.
- Lighting levels in commercial and industrial space should be reassessed and in most cases lowered.
- Limitations on the amount of heat exhausted through chimney stacks and ventilation systems would lead to increased use of heat recuperators and heat exchangers.
- District heating systems should be actively promoted.
- Performance standards for new housing stock would lead to greater attention being given to site design, building orientation and thermal efficiency.
- Low interest loans should be made available for energy conservation purposes which would lead to increasing efficiency of energy use.
- Durability standards would eliminate the need for much manufacturing energy.
- Recycling systems for metals and glass and paper should be set up. Material recycling would save energy used in primary industries.

Energy Probe thanks Simpsons-Sears Limited for financial assistance in printing this pamphlet.

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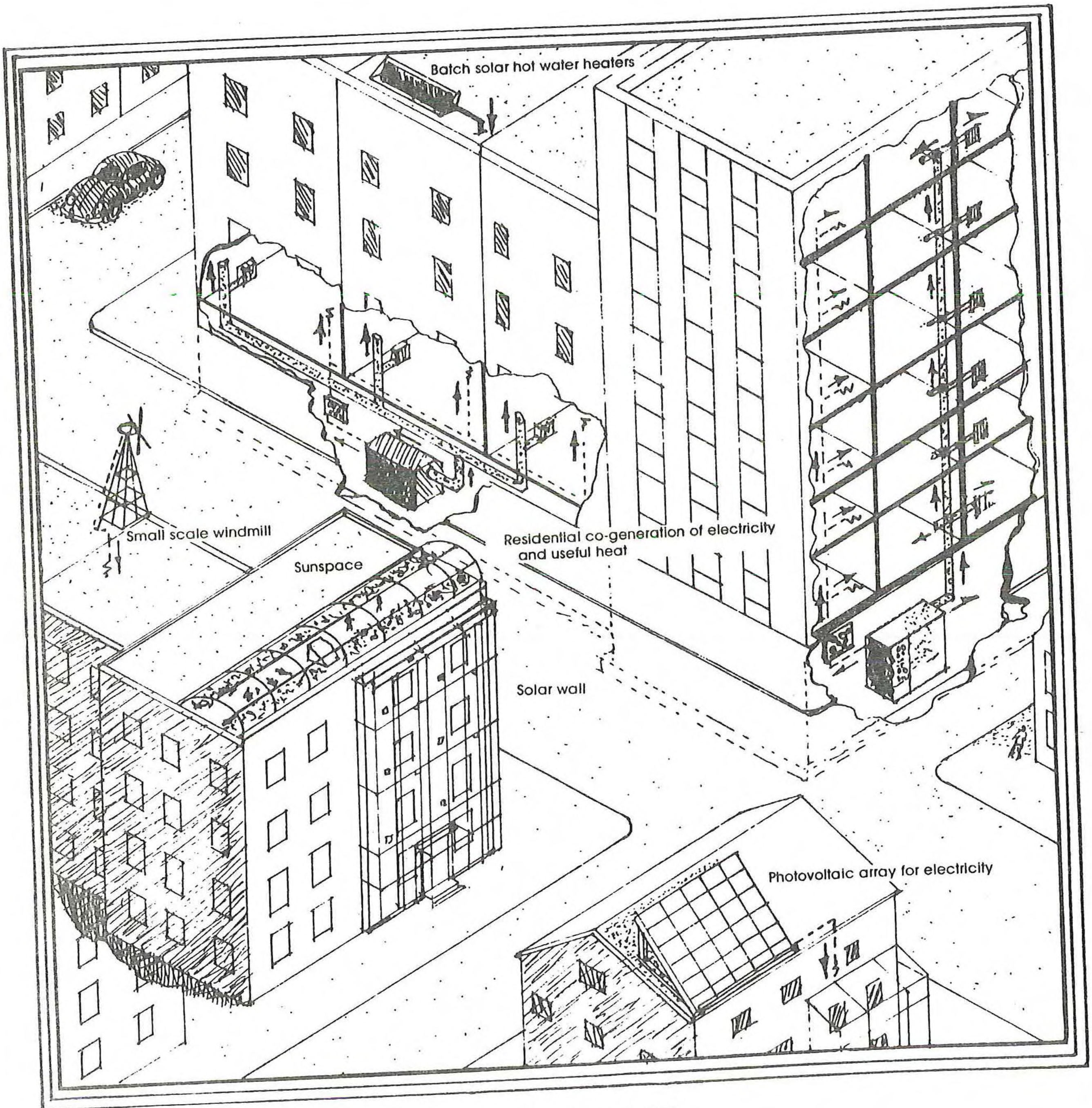

FROM THE GROUND UP

WIND ENERGY

Wind energy appears to have significant potential in some parts of Canada. Originally developed in Persia at least two hundred years before Christ, windmills were introduced into Europe by the Crusaders. By the 18th century, the Dutch had developed the most advanced economy in Europe based on wind power. By the late 19th century, there were almost 24,000 windmills performing a wide variety of tasks throughout northern Europe. However, at that time, windmills began to be replaced by steam engines.

Small-scale Wind Generating Systems

Small-scale electricity generating windmills (properly called windgenerators) were developed at the beginning of the 20th century for rural areas. Several thousand windgenerators in the 100 to 3,000 watt range powered farms across western Canada and the United States. The best known manufacturers were Wincharger and Jacobs. Most windgenerators were phased out by the rural electrification programmes of Canada and the United States in the 1940's and '50's. In recent years, many of the Jacobs and Winchargers have been purchased second-hand and restored by modern homesteaders. (See Figure 1)

With the onset of the energy crisis in 1973, and the possibility of real shortages in the next few decades, interest in wind energy has been renewed. People have begun to buy windgenerators for their homes, farms and cottages, either because they face high installation charges for hydroelectric lines or simply because they want a clean renewable source of energy.

The most popular windgenerators have been the American Wincharger, the Australian Dunlite, and the Swiss Electro, all companies with a long history of manufacturing reliable windgenerators for isolated locations.

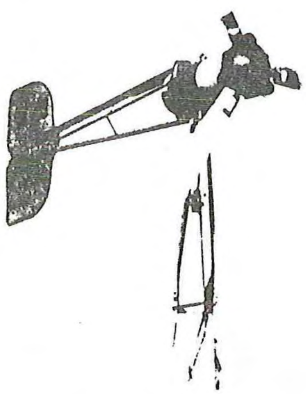

Fig. 1 Recycled 3KW Jacobs

Wind Energy System Components

The 200 watt 12 volt Wincharger is a small, rugged machine which can provide enough power for basic lighting, a radio and possibly a stereo. It costs about $600 in Canada, including the tower but not including storage batteries. A 36 volt model is also available, three of which connected in series would provide a reliable 600 watt 110 volt system.

Basic Design

That solar heating is rapidly gaining credibility in Canada is refl(by the number of solar homes that have recently been constructed. In 1974, o(one solar home was operational, built privately by Eric Hoffman in Surrey, B.C. Now, at least 30 solar homes have been built in Canada and many more are under construction or in the planning stage. A variety of design approaches are represented in these houses and in this section we will look at a number of these in order to provide some perspective on fundamental design characteristics.

Basically, a solar heating system consists of a solar collector, a heat storage reservoir, a heat transfer system to deliver collected heat to the storage reservoir and finally a conventional heat distribution system. (See Figures 4 and 4a). System operation involves trapping solar energy as heat on a black collector surface and then circulating a fluid over the collector surface to draw the heat off to a storage reservoir (normally in the basement). The stored heat is then distributed to the house as required, most commonly using air ducts such as those used with forced-air furnaces.

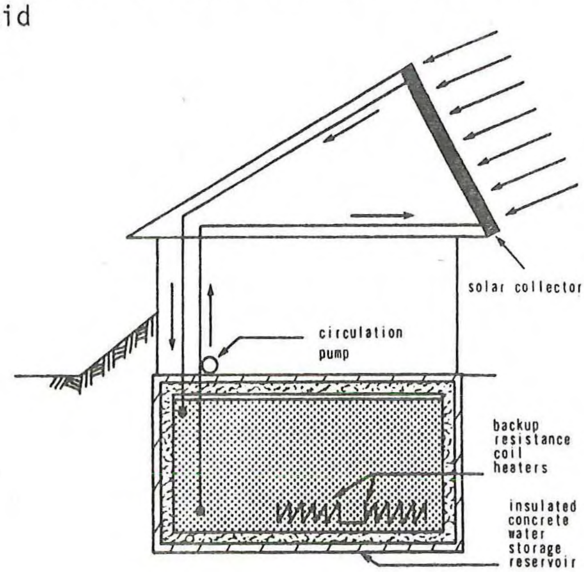

Fig. 4 Typical solar heating system

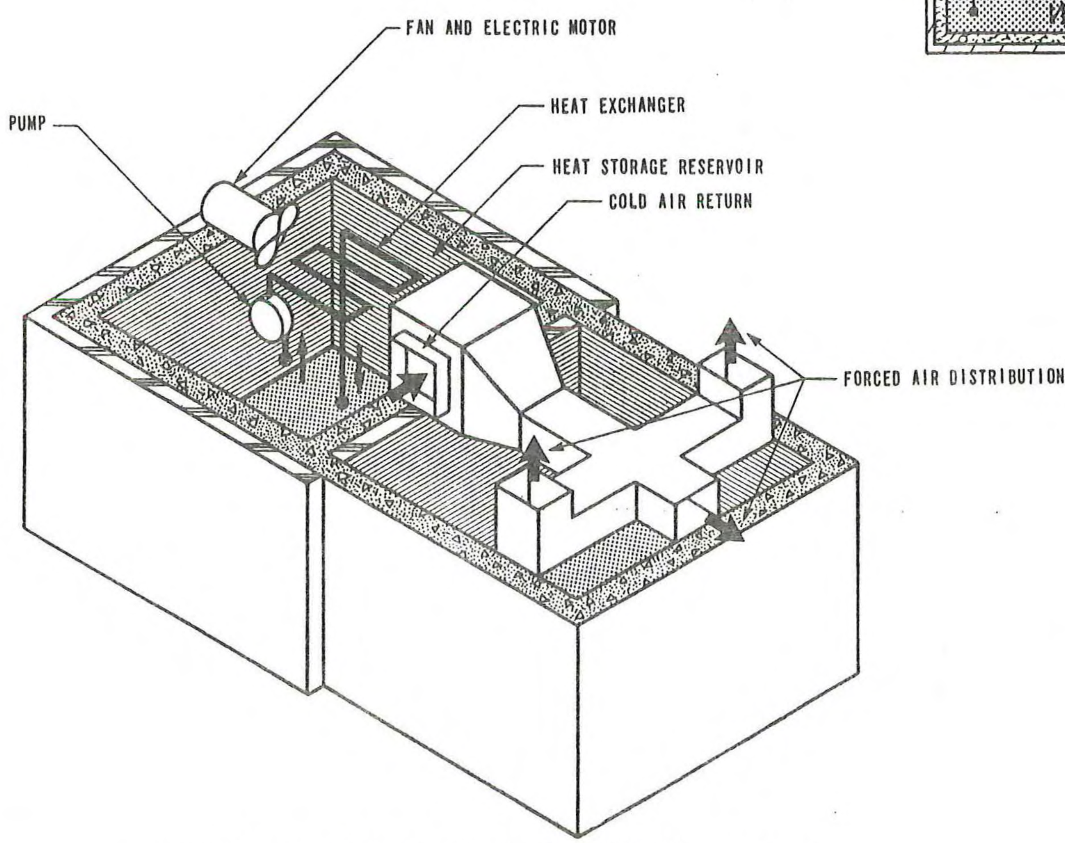

Fig. 4a Forced-air heat distribution system

A DRAFT PROPOSAL ON ENERGY CONSERVATION

JUNE 1989

Objectives

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To reduce Toronto's need for electricity by an amount sufficient to eliminate the need for Ontario Hydro to build "Darlington B", or any other large power station.

To reduces the consumption of fossil fuels in Toronto because this is the most important way to fight acid rain and the greenhouse effect.

Assumptions

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Programs which involve intrusive regulation, massive new expenditures or a large bureaucracy will not sell politically and hardly ever work.

Initiatives must be economically, environmentaly and socially sustainable. All programs must make good business sense.

The costs of efficiency improvements must be compared with the total costs of energy consumption, not with that fraction which appears on the energy consumers bill. Current energy consumption is financed largely by the environment, the taxpayer and future generations. It is important to express the real total costs of the nuclear and fossil fuel options so the public can judge what makes good business sense.

There is a widely held perception that economic growth and growth in energy consumption are locked together. Efficiency in the '90s must centre on the increasing of economic output per unit energy input. Technology has increased the efficiency with which labour is used. It will increase the efficiency with which energy is used.

The debate must move beyond the Coal v Nuclear question. Unlimited expansion of generating capacity is not our only energy option. Increasing the efficiency of electricity use to economically sound levels will free the nuclear industry to devote its full resources to the vital problems of waste disposal and reactor decommissioning.

Approach
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Provide financing (!! not grant funding !!) for investments in efficiency improvement. The City's investment must be recovered, and it should be recovered from the consumer rather than from another level of government.

Government can amortize costs over a longer time frame than business or individuals can. Rate increases must recover the costs otherwise the policy will not be economically or politically sustainable. Voters must recognize environmentaly sound government as financially responsible.

These ides do not require new borrowing. We should re-direct spending from expending generation capacity to improving efficiency with which the existing generating stock is used.

Although nuclear fear shapes public opinion and the immediate objective is to stop Darlington B, these proposals should not be understood as anti nuclear. Energy efficiency is not an adversarial activity. It is a cost effective and environmentaly responsible way to provide people with the energy services they require.

The Down Side
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We cannot talk about cleaning up the environment without recognizing that some people make their living creating pollution.

These policies will adversely effect the interests of the electric space conditioning business.

Conflict will arise with that part of the economy based on material production and marketing. If nuclear power is unnecessary what becomes of uranium miners? If controlling the acid rain means reducing the use of fossil fuels what becomes of the investment and jobs in the hydrocarbon industry?

Philosophy

Energy policy must be based on providing energy services - communications, transportation, space conditioning, industrial heat and power - rather than raw energy. Policy should not focus on supply until it is certain that what we already have is being used in an economically and environmentaly responsible way.

People must help themselves. Government can provide logistical support but cannot impose efficiency on a disinterested public. They must have all the facts and be prepared to accept responsibility for social decisions, their consequences and their obligations.

Democracy must be an informed activity. It is not appropriate for the State to obscure the costs of energy consumption even if the public prefers not to know. We cannot duck responsibility for our choices and dump the financial and environmental costs on future generations. The future is now.

Study areas - Look Before You Leap

Current Usage

Step one in increasing the efficiency of energy use is to determine how we use energy now. Are we employing the most cost effective way of meeting our energy needs? This cannot be determined until present demand patterns are understood. The purpose of this study is to identify the best opportunities for efficiency improvements.

Comparative Usage by Other Cities

Toronto never confronted the high energy prices of the early '80s. There is a great deal to learn from the successes and failures of other cities which had no choice but to face much higher prices. How are other cities more efficient than Toronto and how did they get there? This is an important step in the process of target selection.

Consumption Projections

The "need" to build power stations is a response to projections of demand. What assumptions does Hydro make about efficiency increases? What effect would increased efficiency have on the requirement for new generating capacity. Which can be adjusted at a lower cost, the efficiency assumptions or the generating capacity? What happens to Hydro load projections if the promotion budget is reduced to zero?

Accounting

Accounting methods must be developed which describe the total costs of various energy alternatives. The effect of subsidies must be recognized. The costs imposed outside monetarized accounting - the effects on the environment or on health must be considered when financial decisions are taken.

Board of Education

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Upgrade physical plant and involve the students in the process. Energy efficiency is more than technology. It is a social attitude. Waste is irresponsible and destructive. Students should have an an environment where making things work better is part of the daily routing. Where efficiency and initiative are encouraged, praised and rewarded.

Improvements can be treated as education projects incorporating the students as much as possible. What was changed, why was it changed. Monitoring of energy consumption would allow students see the results of changes.

Let's sponsor a category in the School Science Fairs for Energy Efficiency with prizes and scholarships. Students should have the opportunity to have their best ideas implemented in their schools. Schools, science teachers, shop teachers etc. should be in a position to benefit from successful efficiency projects.

Red Tape Department

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Any program to change energy consumption patterns will involve all levels of government. Borrowing authority will have to come from the Province. The City is in a better position to administer local programs. Since energy consumption is more decentralized than energy production local programs will be more effective at increasing energy efficiency. Will this encourage turf wars? How do we avoid this?

Are City efficiency goals in conflict with the goals of other governments? Is Ontario Hydro contemplating Darlington B as a reaction to projections or is it using projections to justify what it wants to do anyway? The interests of the City as a major energy consumer are not necessarily the same as the interests of energy producing industries or jurisdictions.

Subsidies and promotions designed to increase consumption of any kind of energy should be discouraged. This should start with electricity but should be understood as ultimately applying to any form of energy consumption promotion. Energy demand should be in response to need rather than advertising.

Lighting

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Commercial lighting could be the Blue Box of public awareness for an energy efficiency program. The City would finance the replacement of all the lighting fixtures in a building and cover the cost with increased rates. In a building where lighting is over 80% of electric demand quadrupling the efficiency and tripling the rates gives positive cash flow in the first year.

This program could be brought on stream as a demonstration quickly. It uses existing technology. Lot's of people could see it. The results from monitoring would come back at once. If these results confirmed expectations the program would be easy to expand.

The City could solicit offers from the private sector to participate. It would be good business and good public relations for the client.

Residential

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Canada is a leader in energy efficient building technology. Ten years ago that technology existed but there were not enough people who knew how to use it. Today there is a pool of experienced trades people to act as teachers. The big efficiency gains in the residential sector will come from construction and renovation rather than from high tech devices.

Putting Low E glass in poorly built frame is a waste of money. There is no point in funding consumers until the delivery system exists. Trades training now is indispensable to any future program of residential efficiency improvement.

The City and the Board of Education, in co-operation with the Canadian Home Builders Association and the construction unions can expedite this training. This is a necessary first step toward increasing the efficiency of the residential building stock.

Industrial Consumption

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The city could encourage factory modernization by arranging financing for improvements which would result in increased energy efficient. The Industry in question would accept higher rates to cover the costs. The higher rates would guard against a lowering of standards after the original investment is paid for.

This program could have a high R&D content. There are great possibilities in high tech efficiency - computer monitoring and control, high efficiency appliances and motors etc. There is also an industrial development component. Locate in Toronto or stay in Toronto and the City will help you modernize.

Alternative Production

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To reduce the demand placed by Toronto on Ontario Hydro for ever increasing amounts of electricity Toronto Hydro should seek other forms of supply.

This would involve changing the Toronto Hydro from being a single source distributor to a multi source distributor. The city could provide financing and guaranteed markets as long as that production costs less than a new nuclear station. Premiums could be paid for production at peak consumption times. The most prominent possibility in this area would be industrial co-generation.

The utilities role changes from being a distribution utility for Ontario Hydro to being a buffer and backup for many smaller producers. This is the most aggressive and adventurous element of these proposals.