TOPIC

WHAT CAN MUNICIPALITIES DO ABOUT ENERGY?

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This Topic In Brief

This *Topic* *demonstrates that Ontario municipalities can play an important role in promoting the more efficient and less extravagant use of energy and the development of renewable energy supplies.*

We point to four areas for municipal action: land-use and transportation planning, building and site design requirements, the development of local renewable energy sources, and public education and demonstration programmes. We look at both the opportunities open to municipalities and the existing barriers to be overcome.

The *Topic* *argues that the case for municipal initiatives in energy planning must be seen in the context of the provincial and national energy picture. The problem is not that a shortage of energy is imminent, but rather that it will become progressively more expensive in time, technology and capital to extract and deliver conventional fossil fuel resources. Most analyses indicate that over the next 50 years we must pass from a reliance on non-renewable fossil fuels to a reliance on renewable energy sources. Thus, to accomplish this transition we must conserve the energy supplies we now have, and develop new ones.*

In view of this situation, there are good reasons why a municipality should act. First, a municipality has the capacity to influence how energy is used at the local level, by virtue of its planning and other regulatory powers. Second, a municipality can save on energy costs, for itself or for the community it represents. Third, a municipality would be wise to develop some measure of local energy self-reliance if possible. Finally, energy considerations can reinforce other municipal objectives such as efficient land use and environmental protection.

The opportunities we outline are consistent with the Science Council's "conserver society" principles now receiving much public attention. We suggest that municipalities should initiate internal energy management programmes and encourage school boards to do the same. Municipalities should instruct staff to develop a comprehensive energy management programme, covering key land-use and transportation factors, for the community as a whole. Municipalities should encourage and be receptive to applications for energy-efficient design or upgrading of buildings. They should sponsor or participate with other groups in demonstration and pilot projects of renewable energy technologies and processes. They should pressure the local utilities to adopt an aggressive conservation role. Finally, municipalities should lobby senior governments for needed financial and legislative changes.

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INTRODUCTION

The purpose of this *Topic* is to demonstrate that municipalities have a major role to play in promoting the prudent and efficient use of energy. We will highlight four areas for municipal action: land-use and transportation planning, building and site design requirements, the development of local renewable energy sources, and public education and demonstration programmes. For each, we shall look in a selective rather than a comprehensive way at the opportunities for municipal initiative and the existing barriers.

But first we must be clear on the meaning of the energy problem. And second we must appreciate why *municipalities* should become involved in energy conservation and renewable energy technologies.

It is important to note at the outset that we use the term conservation to mean both *reduction in the demand for energy* and *improvements in energy efficiency*. Reducing demand means using less energy to achieve the same ends and involves minor lifestyle changes like turning off lights, lowering thermostats, driving smaller cars, car pooling and reducing household garbage. Achieving greater efficiency means doing more with each unit of energy expended and involves greater changes in attitudes and behaviour as well as changes in technology. These technological changes usually fall into two categories:

— those which minimize waste of energy by such direct methods as insulation, temperature and lighting controls, improved furnaces and car engines;

— those which create a better match between the type of energy used and the task for which it is needed (the end use). For instance, we know from physics that it is more efficient to heat water directly, using a fossil fuel or a renewable source such as sunlight, than to use electricity, which is better suited for driving machinery.[1]

The use of *renewable energy sources* such as the sun, wind, running water and biomass (organic matter from plants and animals) is bound up with a serious conservation approach. Not only are renewable sources better suited for certain tasks but also they can help us to stretch out our supplies of non-renewable fossil fuels.

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1 This basic law of physics is known as the "Second Law of Thermodynamics". For a useful explanation of thermodynamic efficiency, see B. Commoner, The Poverty of Power (Knopf, 1976).

I THE ENERGY PROBLEM

The Energy Crisis

In its broadest sense, the energy issue embraces and symbolizes a whole range of environmental, economic, and social concerns. The pattern of continually increasing resource consumption and growing energy waste that has accompanied post-war economic growth has led many to view the energy issue as a symptom of a much deeper behavioural and institutional problem. From this perspective, the energy problem is one of attitudes and lifestyles, of scale and appropriate technology, of ecological balances in the biosphere, and of our economic system.

For example, noted environmental scientist, Barry Commoner, explains how energy inter-connects with other major problems such as environmental pollution, unemployment, and capital shortages confronting North American society. To deal effectively with the energy problem, argues Commoner, we must correct basic faults inherent in our economic system such as our dependence on an ever-expanding economy, with the concomitant reliance on vast reserves of resources and on the substitution of capital for labour.[1]

The Science Council of Canada also interprets the energy issue as a complex one, merging environmental, political and economic concerns. It emphasizes that we are at a critical juncture in our history and that survival of the natural system of which we are a part is at stake. The Science Council argues that we can begin to overcome our pollution and waste disposal problems, avoid capital shortages and economic dislocation, and live within our biological, social and physical resource limits by adopting a *conserver approach*. The conserver society, as opposed to the consumer society, is on principle against waste and pollution, and its touchstone is "doing more with less". The conserver society takes into account the total costs of our actions, to ourselves and to future populations.[2]

The writings of Amory Lovins complement the conserver approach and underscore certain of its aspects. Lovins sees the need for smaller-scale, decentralized production and distribution activities and for local self-reliance (meeting community needs from local resources wherever possible). Lovins also

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1 Commoner, op.cit., Chapters 8 and 9.

2 Science Council of Canada, Canada as a Conserver Society, Report No. 27, September, 1977.

emphasizes that there are basic energy choices and that these choices are not neutral but rather have differing social and economic consequences. He stresses the importance of ensuring a sustainable future through the development of *appropriate technologies* based on the "soft", renewable energy sources.[1]

In more elementary terms, the energy problem is a matter of diminishing fossil fuel resources and rising costs. Because North American growth and prosperity in this century has been based on relatively cheap and abundant energy, primarily oil, oil has come to epitomize the energy problem. The 1973 Arab oil embargo signalled an end to this age of cheap energy and introduced the concept of the "energy crisis" into the popular vocabulary. The crisis is not that a shortage of energy is imminent, but rather that it will become progressively more expensive in time, technology, and capital to extract and deliver conventional fossil fuel resources. And ultimately fossil fuels are finite.

Most analyses indicate that over the next 50 years —by the year 2025— we must pass from a reliance on non-renewable fossil fuels to a reliance on renewable energy sources. Most also agree that this transition must begin now.[2] But there is a wide range of opinion regarding how the transition should start and what the ultimate supply mix —after 2025— should be.

Complicating this issue, particularly in Ontario, is the fact that electrical power in some cases is coming to substitute for primary (fossil) fuels. This raises the nuclear debate. Although the highly controversial and complex subject of nuclear power is clearly beyond the scope of this *Topic*, it forms an essential part of the context.[3] The question of a municipal role in energy planning cannot be separated from the larger issue.

Oversimplifying this debate somewhat, the basic choice appears to be whether we look to nuclear power, uranium-based during the transition period, with the potential of thorium or plutonium in the longer term, or whether we de-emphasize nuclear in order to make an all-out commitment to conservation and the associated development of appropriate technologies based on renewable energy sources.

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1 A. Lovins, Soft Energy Paths: Toward a Durable Peace, Penguin Books, 1977. Lovins' "soft" path refers to the development of renewable energy sources and alternate technologies, such as solar, wind, tidal, biomass conversion. He sees fossil fuels and nuclear power as the harder paths, and ones that are ultimately destructive.

2 As one of the major oil companies has stated, "our task now must be to find enough additional supplies to wean ourselves from our petroleum diet and switch to a renewable-based energy economy". See Imperial Oil Review, 62(1), 1978, p. 29.

3 For a useful and balanced summary of the nuclear issue, see Peter Mueller, On Things Nuclear: the Canadian Debate, Canadian Institute of International Affairs, 1977.

In reality, of course, the choice is not as clear-cut; Ontario, for instance, will always depend on hydro-electric power to some degree and, even with an increasing proportion of nuclear-supplied power, will have to be concerned about reducing consumption and using all energy sources efficiently. Thus technically, nuclear and conservation are not incompatible.

The crucial point is that, *on a practical and political level, nuclear power and a serious conserver approach do represent opposite paths*. The choice between the two involves how we allocate our tight financial resources, our research and development efforts. It also involves the recognition that what we do now will determine in large part the kind of energy supply mix we can have after 2025. As Amory Lovins argues:

> "A soft energy economy is attainable only if we begin our transition to it promptly, before other commitments have depleted our stocks of money, time, fluid fuels, skills, and political will, locking us firmly into an electrified high-technology trap."[1]

A review of federal and provincial energy policies indicates that neither government has acknowledged this immediate choice.

Canada's Energy Future

Canada's present pattern of energy consumption is characterized by waste. Canadians have the dubious honour of ranking highest in the world in per capita consumption of energy.[2] Our record is often contrasted to that of Sweden, a country with similar climatic and demographic features to Canada and which enjoys a comparable or higher standard of living, but which consumes only about 2/3 the amount of energy per capita. Moreover, the Swedes are moving much faster than we are to improve their own energy efficiency.

Canada ceased to be self-sufficient in oil in 1976 and is now a net importer of more than 300,000 barrels a day. Scenarios developed by the Department of Energy, Mines and Resources suggest that, in the absence of specific government action, by 1985 we may be importing between 950,000 and 1.2 million barrels of foreign oil per day, or between 40% and 47% of anticipated

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1 A. Lovins, "Exploring Energy-Efficient Futures for Canada", Conserver Society Notes, 1(4), p. 16.

2 Figure used by the International Energy Agency, 1976. A recent federal report notes in this regard that "after all of the obvious factors such as climate, geography and industrial structure have been accounted for, a difference remains between the rates of energy consumption in North America and elsewhere that is only explainable on the basis of lifestyles and relative efficiency of energy use". See Department of Energy, Mines and Resources, Energy Conservation in Canada: Programs and Perspectives, Report EP77-7, 1977, p. 4.

oil requirements. This would be costly —some $5 billion a year at today's world price of $14 per barrel. Bearing in mind that oil represents close to 50% of the primary energy consumed in Canada, it would also mean a high degree of dependence on risky sources in an uncertain world. According to the federal energy minister, "there is a looming energy crisis which is not far away. It may not yet be perceived by the public. It is not unlike, in many regards, the iceberg which sank the Titanic".[1]

The central goal of Ottawa's 1976 energy strategy is energy self-reliance, meaning, "supplying Canadian energy requirements from domestic resources to the greatest extent practicable and taking all appropriate actions to protect Canadians against interruptions in the supply of energy we continue to import".[2] The cornerstone of this policy is the target for imports: by 1985 Canada's dependence on foreign oil must be no greater than one-third of its needs. A second important target of this strategy is to reduce the average annual rate of growth of primary energy consumption to 1985 to less than 3.5%. (The 3.5% growth rate is based on a high price - low economic growth scenario and compares with an average rate over the past 15 years of 5.5% and a projected future yearly increase of 3.7%.) Conservation is regarded as one of nine "policy thrusts" for achieving these targets; the document notes that higher prices alone will not reduce consumption "as far or as fast as desirable".[3] Nevertheless this 1976 report provides little discussion of where and how the nation should conserve.[4]

A more recent study from the Department of Energy, Mines and Resources indicates that a primary energy demand growth rate of *less than* 3.5% per year over the period to 1985 is now "clearly attainable".[5] Moreover, the analysis suggests that this figure could be as low as 2% averaged over the 1975 to 1990 period, if conservation measures such as the ones set out in the report are implemented.

This new report is proof that more thought is being given to conservation and renewable energy supplies. Still, about 8% of the 1977-78 funds for energy research and development has been allocated to conservation, and 6% to renewable energy, in comparison with 70% for the nuclear programme.[6]

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1 The Hon. Allistair Gillespie, Minister of Energy, Mines and Resources, House of Commons Debates, October 21, 1977.

2 Department of Energy, Mines and Resources, An Energy Strategy for Canada: Policies for Self-Reliance (1976), Summary, p. 3.

3 Energy Strategy, ibid., full report, p. 131.

4 The report listed briefly several initiatives the federal government itself had taken or was about to take, among these, new mileage standards for automobiles, a revised national building code incorporating energy-efficient standards, minimum energy standards for appliances, an in-house energy conservation programme, and a home insulation programme.

5 Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., p. 12.

6 Ibid., p. 47.

Ontario's Energy Future

The main forms of primary energy used in Ontario are as follows:

Oil	39.8%
Natural Gas	24.1%
Coal	14.7%
Uranium	5.6%
Electricity (hydraulic)	12.9%
Electricity (purchased)	2.9%
	100.0%

Of the various forms, only uranium and hydro-power are indigenous to Ontario, and only hydro is renewable. For a province which imports more than 80% of its energy requirements from the rest of Canada or other countries, and which is heavily dependent on oil, the energy problem is especially serious.

Energy development in Ontario now stands at a crossroads. In view of the uncertainty of future oil and gas supplies, electrical generation is of growing importance. Thus the key to Ontario's energy future is bound up with the future planning of Ontario Hydro.[1] Until the early 1970's, Hydro planned on the basis of a projected annual increase in electrical consumption of 7%, meaning a doubling each decade. To satisfy this anticipated demand, Hydro looked primarily to the province's substantial reserves of uranium and advanced CANDU nuclear technology (which would extend the life of uranium). Coal as a fuel source for additional electrical generation would continue to be used, as would the existing large-scale hydraulic systems, but the future ratio would favour nuclear.

By 1975 the problem of financing this vision of a nuclear electric future had arisen. Ontario Hydro requested a 30% rate increase that year. This together with Hydro's growing borrowing requirements made it clear that the traditional approach —continued stimulation of energy demand (by a variety of interest groups as well as Hydro) to be met by "unlimited" nuclear power— had to be changed. In 1975, the Royal Commission on Electric Power Planning (the Porter Commission) was established with a very broad mandate to enquire into Ontario Hydro's long-range planning programme as it relates to provincial energy needs. The Commission is expected to present an interim report in June 1978, and the final report in December 1978. In addition, a Select Committee of the Legislature was recently appointed to examine Ontario Hydro's current and future operations. Since both groups are examining Hydro's planning, their terms of reference overlap to some extent. Each, of course, can only comment and make recommendations on the plans of the large power utility.

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1 The background summary is based on two articles in Alternatives (Fall, 1977): Doug Torgerson, "From Dream to Nightmare: The Historical Origins of Canada's Nuclear Electric Future", pp. 8 - 17, and Ron Argue, "Renewable Energy for Ontario", pp. 56 - 64. The Ministry of Energy publication, Ontario's Energy Future, op.cit., was also consulted.

Whether Ontario should become an increasingly nuclear-dependent society is at the heart of the overall provincial energy debate. The province's nuclear programme is already substantial, representing the bulk of Canada's nuclear power industry. In 1977, about 24% of the electrical energy generated by Ontario Hydro was nuclear, produced by the reactor at Douglas Point, the four at Pickering A and, the two at Bruce A. Fourteen additional commercial-scale nuclear reactors are either under construction or have been approved. The provincial government has still to take the final decision on Hydro's future plans.

In the meantime, the Ministry of Energy's primary policy document (Ontario's Energy Future, April 1977) does not deal with the possibility that continued emphasis on the nuclear alternative might undermine other long-term options. The document stresses the need for a stronger effort to conserve energy and develop renewable resources. At the same time, the dominant theme is that Ontario cannot avoid a greater commitment to nuclear power. The report envisages a short-term reliance on non-renewable energy (oil, gas, coal and uranium) with a transition to new sources, particularly advanced-technology nuclear electricity, during the next fifty-year period. It states that renewable sources such as the sun will also be important in the long term, but it does not accord high priority to them now. It anticipates that just 2% of our energy requirements to the year 2000 will be met through renewables. The document notes that short-term demands will compete with long-term requirements.

Critics of this approach concede that Ontario is moving in the right direction, but query whether its commitment to conservation and the development of renewable sources is enough. They point out that the budget is growing (over 100 research and demonstration projects) but is still comparatively small in relation to other energy expenditures and to the job that needs to be done. They are worried that, given the long lead time required for the development of any new source, we will not be able to make the full transition when it is needed. Presumably the Ministry of Energy's update to this policy, expected in late spring, will deal with these unresolved issues.

The Logic of Conservation

Before reviewing the case for a municipal role in conservation, it is helpful to remind ourselves of the benefits of a full conservation approach:

i) *Conservation can have a substantial impact on reducing energy demand*. The federal government supports conservation programmes "because they represent the most immediate, lowest-cost and lowest-risk means by which we can contribute to the achievement of our objective of self-reliance".[1] David Brooks, former Director of Ottawa's Office of Energy Conservation and now the Co-ordinator of Energy Probe (Ottawa)

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1 Department of Energy, Mines and Resources, Energy Strategy, op.cit., p. 133.

maintains that: "with the simplest kinds of approaches —smaller cars, fiddling with controls, turning off the lights and insulating— we can cut the projected growth in Canada's energy consumption through 1990 in half". Brooks is quick to emphasize that with greater changes in lifestyle, but still without any real sacrifice, we can get to zero energy growth per capita (where primary energy growth of 1.3% equalled the population increase) or even zero absolute energy growth.[1]

ii) *Conservation can minimize Canada's and Ontario's reliance on oil imports*, thereby reducing our vulnerability to world price changes or supply restrictions.

iii) *Conservation can slow down the demand for capital* needed in high-technology energy development, whether for new oil and gas supplies or nuclear power. This would leave more resources for other capital projects, consumption, or other social and environmental goals.[2]

iv) *Conservation can create jobs and present new opportunities for small business*. The Science Council asserts that "a conserver approach will lead to the introduction of new technologies, new opportunities for Canadian business, and unprecedented challenges to the entrepreneurial spirit".[3] Such opportunities are associated with retrofit programmes (the modification of existing buildings to save energy and increase energy efficiency), new construction, and the development of renewable energy technologies and processes. The jobs created are expected to be more varied in type and more suited to small business ventures. In comparison with high-technology energy projects, they should be more broadly distributed throughout the country.[4]

v) *Conservation and technologies based on renewable resources can assist in maintaining environmental quality*. The extraction and use of fossil fuels and the generation of electrical power all have environmental side-effects that contribute to ecological degradation. And, while we do not know how particular factors interact in given situations or the full extent of environmental damage that has been done or is being done, we believe that the ecological balance is a delicate one and that once it is upset, it may be very difficult to recreate.

vi) *Conservation can buy time*, allowing us to stretch out our fossil fuel supplies and prepare for a lower consumption lifestyle. To appreciate the importance of time, one needs only to recall Lovins' argument that the sheer magnitude of the proposed nuclear expansion strategy in time, effort and capital required threatens to foreclose adequate development of the renewable energy option.

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1 See David Brooks, "A Real Option: Conservation to 1990 and Beyond", Alternatives (Fall 1977), pp. 48 - 54.

2 See for instance, F.H. Knelman, "The Conservation Option and The Sustainable Society", Alternatives (Fall 1977), p. 45.

3 Science Council, Canada as A Conserver Society, op.cit. p. 55.

4 See F.H. Knelman, op.cit., pp. 45 - 46.

II WHY MUNICIPALITIES SHOULD GET INVOLVED IN ENERGY PLANNING

It might seem at first glance that energy planning should be done by the federal and provincial levels of government —because of the international dimensions of the energy problem, because of the constitutional responsibilities of the senior governments for resource management, environmental protection, energy pricing, research and development, and so forth, and because of the broad social and economic goals to be served by conservation programmes. Yet there are good reasons why municipalities should take the initiative in planning for a conserver society.

First, reduced consumption and increased energy efficiency can save money. For instance, it is possible to reduce the energy requirements of existing housing by 30% to 50%, and of new commercial buildings by up to 75% or more. The benefits of lower energy bills would accrue to the municipal corporation itself, where its own buildings were involved, or to the community represented by the municipality.

Second, municipalities have the capacity to initiate effective energy policies and programmes. By acting directly (for example, through capital programmes like laying roads or pipes, or through providing transportation services) as well as by regulating private sector activity (chiefly through planning controls), a municipality has leverage in the four main energy-consuming sectors of our economy: commercial, domestic/farm, transportation and industrial. While a breakdown of energy use by sector is not yet available for Canadian cities, the figures below show how energy is consumed in Ontario:[1]

Ontario's Energy Use in 1974

By sector:		Used as:	
Commercial	12.8%	Coal Products	8.0%
Domestic and Farm	17.9%	Electricity	11.7%
Transportation	21.6%	Natural Gas	24.0%
Industrial	31.1%	Petroleum Products	39.7%
(Conversion Losses)	16.3%	(Conversion Losses)	16.3%

In this *Topic* we will demonstrate how municipalities can affect energy consumption by influencing land use and the built environment, by taking the lead in developing local energy supplies and appropriate technologies, and by promoting a conserver lifestyle through public education and demonstration programmes. While clearly municipal government cannot solve the energy problem by itself, it cannot afford to overlook its own potential role.

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1 Researchers in the Faculty of Environmental Studies at York University are developing energy consumption statistics by sector for Metro Toronto. The figures listed here are from Energy Planning in a Conserver Society, prepared by Energy Probe, Toronto, for submission to the Royal Commission on Electric Power Planning, February 1978, Figure 10, p. 56.

Third, a conserver approach can reinforce other municipal objectives —social, economic and environmental. For instance, the kind of land-use patterns which epitomize energy waste, specifically low-density, automobile-dependent suburban sprawl, have come to be viewed by an increasing number of planners and politicians as uneconomic, destructive of farmland, and environmentally damaging.[1] Thus energy-efficient community planning is compatible with this view of sensible comprehensive planning. Some also argue that conservation measures which improve the efficiency of direct energy usage by individuals will have a beneficial impact on the purchasing power of low-income groups.[2]

Fourth, developing some degree of local self-reliance seems prudent. Given the national and provincial energy picture, with warnings of cost rises and even supply interruptions, a municipality would be wise to investigate all opportunities open to it. A measure of independence from our centralized energy production and distribution system would both reduce the demands on that system, so precluding the most dire forecasts, and provide some local security should the system break down even temporarily (for example, electrical blackouts, nuclear plant shutdowns, or pipeline accidents).

Davis, California (population 33,000) stands out in North America as a city with a strong commitment to conservation and the use of renewable energy supplies. This is the result of a simple decision by residents and their city council to not leave energy policy solely to other levels of government, their agencies or private industry. Within a state framework which encourages local government to guide its own destiny, energy management has become part of Davis' overall plan to control the nature and the rate of growth in the community.[3] This municipal initiative has facilitated public participation in a broad social issue and created a willingness to become involved in its solution.

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1 See, for instance, the Urban Development Institute study prepared by John Bousfield Associates and Paul Theil Associates, Lowering the Cost of New Housing (February 1976). This report contains data showing that current development standards are one factor in promoting wasteful usage of land and high transportation and other servicing costs.

2 See Department of Energy, Mines and Resources, Energy Conservation in Canada op.cit., p. 5.

3 See The Davis Experiment: One City's Plan to Save Energy, published by the Public Resource Center, Washington, 1977. Davis, a town of 33,000 people about 70 miles northeast of San Francisco is often cited as the most energy-efficient city in America. As a campus town it is admittedly not typical, but its efforts are worth noting: special bicycle lanes on all major streets, narrower roadways, recycled garbage, an energy-related building code. The local zoning encourages building orientation which maximizes passive solar heating and guarantees sun rights in new developments. The plan, which was based on an ordinance drafted in 1975 by a committee of architects, planners and interested citizens, has led to significant energy savings.

III OPPORTUNITIES FOR MUNICIPAL INITIATIVE

Opportunities for municipal action in energy management include the following:

- land-use and transportation planning decisions,
- building and site design requirements,
- the development of local energy supplies, and
- public education and demonstration.

Our intent is to indicate where and how municipalities can act, rather than to present a complete survey of opportunities. Each municipality is unique: the Ottawa area, for instance, is service-oriented, while Hamilton is involved in heavy manufacturing, and Hearst depends on primary resource extraction. Our discussion should provide a guide as to what actions would be appropriate in particular situations.

A *Land-Use and Transportation Planning*

By 1990 most of our expected increase in development will have occurred. Almost 2/3 of the residential stock for the year 2000 is already with us. Thus most analysts urge that we waste no time in applying energy-efficient planning and building principles; the physical transition to a conserver society must start now.

We must be cautious in predicting the savings to be made through municipal land-use and transportation decisions. So far there are few practical demonstrations of such savings. Most testing of alternative development options has been done by computer simulation.[1] We must also remember that our planning system only regulates or attempts to influence what happens; aside from ensuring infrastructure improvements, it has minimal control over whether a particular event happens. *Nevertheless, many observers believe municipal land-use and transportation planning offer the best long-term conservation potential*. A survey prepared by the IBI Group for Environment Canada showed that, while there is scope for conservation programmes at each level of government, the local level has substantial leverage, particularly when the senior levels are unwilling or unable to control such relevant large-scale variables as population distribution or economic development.[2] And recently the Ministry of State for Urban

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1 Another problem when examining American examples in particular is that much of our urban form in Ontario is already built at densities higher than those existing in the U.S. This makes conclusions somewhat harder to draw: should we expect to achieve similar savings, or is there a threshold, so that savings could be less?

2 See Environment Canada, Energy Conservation Through Land-Use Decisions (March 1976), by the IBI Group, Toronto.

Affairs has begun a major "Energy and Urban Form" research programme in order to "provide directions for the urban development process which optimize energy efficiencies in all areas of urban energy demand, to encourage and support urban developments that integrate energy systems and land use and result in a high level of energy efficiency".[1]

There are three things to bear in mind when considering the energy consequences of urban form. First, the energy substitution possibilities are just as important as the energy savings achieved. This means, for instance, that building a community that can rely on renewable energy sources is just as important as building one that uses less energy.

Second, planning decisions should provide the opportunities for a better match between the energy source used and the purpose to which it is put. For instance, planning measures can ensure the densities and land-use mix required for the successful operation of a district heating system based on renewable fuels.

Third, energy concerns must be applied to the existing pattern as well as to new development. While the scope for reducing energy requirements differs between existing and new development, as it does between urban and rural settings or between regional and area planning authorities, each is a legitimate area for action.

The main attributes of an energy-efficient land-use pattern follow logically from the above considerations. They are interdependent:

- "higher density", meaning medium density development rather than low density sprawl;

- an arrangement of uses that reduces the need for travel; the private auto is used less and movement by foot, bicycle or transit increases;

- likewise, an arrangement of uses that results in lower servicing costs and permits the introduction of energy-saving technologies and processes.

Development at higher densities *does not* herald a return to the excesses of the sixties. The antipathy towards building high which arose out of broader social concerns was widespread during the late '60's and early '70's and led to a growing demand for low-rise forms. Few developers are planning a return to the high-rise now. In terms of energy costs, tall buildings have become expensive to operate and, even if new energy-efficient ones were proposed, the public opposition would be strong.[2]

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1 See Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., p. 49.

2 While the high-rise form theoretically has the correct surface to volume ratio to make it energy-efficient, there are very few models to follow. For instance, in many cases high-rise residential construction has been shoddy, with virtually no insulation provided so that the heat loss is enormous. A complicating factor has been the predominance of bulk metering for utilities: paying rents inclusive of flat rates for heating and hot water, tenants have had little incentive to conserve.

Higher density *does* mean a shift away from building more of the sprawling suburban pattern that has been the norm for the past 20 to 30 years. Again, the single-family detached house on a large lot has been in demise in recent years for reasons other than energy. The home ownership "crisis" has been caused by high initial costs which have prevented some households from entering the market. Thus today's marked convergence —by developers, the public, and municipal planners— toward attached housing forms is the result of many influences. Energy is the most recent.

The energy-conserving nature of higher density stems from lower space heating and cooling requirements (due to common walls, small surface area to volume ratios) and reduced transportation and utility infrastructure. In comparison with a single-family detached house, an attached house can mean substantial energy savings. According to one American survey, multi-family housing requires about 30% less energy for heating alone than does comparably-sized single-family housing.[1] For Toronto one study shows a saving of $685 annually on the household fuel bill of a 4-storey townhouse in comparison with the same-sized single detached house built to national standards.[2]

Thus *at a minimum* of 10 to 15 units per net residential acre, the townhouse or other form of attached housing is more conserving of energy, more energy-efficient (for example, if it is hooked up to a district heating system), more affordable than the conventional single-family house, and more acceptable than the high-rise. Metro's planners have settled on a minimum residential density guideline of 15 units per acre.[3] One Toronto researcher estimates that livable, energy-conserving forms could be built at 27 units per acre; these would be 4-storey structures separated into two self-contained dwellings of 2 storeys each.[4]

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1 D. Mosena, "Site Design: Can It Really Save Energy?", ASPO Planning, December 1977, p. 22. This study refers to detached housing at 3 to 5 units per acre. In Ontario's larger urban areas the average is already 7 units per acre, and 5 units per acre throughout the rest of the province.

2 John Hix, Energy Demand for Future and Existing Land-Use Patterns, prepared for the Royal Commission on Electric Power Planning, October 1977, p. 68 (draft version). This is the expected saving in 1979 for a new townhouse. The saving is due not just to the increased density, but to various design features possible in the townhouse form.

3 See "Planning policy to double residential density in Metro", Globe and Mail, January 19, 1978. The draft planning policy, still to be approved by Metro Council, calls for a minimum density of 15 units (40-50 persons) per acre in subdivision developments; this is double the current trend of 8 housing units (24-28 persons) per acre.

4 See John Hix, Energy Demand for Future and Existing Land-Use Patterns, op.cit. The Science Council supports this density ceiling. See Canada as A Conserver Society, op.cit., p. 75. Above this density, it is estimated that housing forms require higher energy input in the construction process.

The term "higher density", then, really refers to a smoothing out of densities or a narrowing of the range of permissible densities, avoiding the extreme highs and the extreme lows. For existing development, it means a rounding-out of densities by means of sensitive infilling.

Higher density also brings with it the potential for reduced use of the private auto. A compact urban form with an appropriate mix of land uses can integrate places of residence, work, shopping and, to some extent, entertainment so that the need for travel is reduced or, at least, the distances are shorter. This is important because in urban areas most trips now are made by auto. In comparison with, say, the diesel-powered bus, the car is highly energy-intensive (using an average of 7,820 BTU's per passenger mile, in contrast to 1,650 BTU's per passenger mile for the bus[1]). An energy-efficient arrangement of land uses could encourage more trips by foot or bicycle. It could also increase the feasibility of public transit, whether bus, streetcar or rapid transit. Naturally the basis of any transit system is the presence of large numbers of riders.

Higher density brings with it a third advantage: the potential for lowering servicing costs as well as better utilization of the built environment. Studies by both the development industry and Ontario's Ministry of Housing have shown that current development patterns waste both land and capital, and recommend that density increases can bring about savings without sacrificing livability.[2] One can also see that higher density encourages better use of what we have built. This is because the mixed use and shared use it permits (rather than segregation and specialization) encourage day-round use of facilities. Moreover, conditions favourable to the introduction of energy-efficient technologies or processes can be created if there is higher density. For instance, district heating systems, which use one central heat source, cannot be used in areas of low-density, dispersed development.[3]

What can municipalities do to bring about this kind of urban form? Very simply, they can plan, and then zone accordingly. In larger urban areas this means devising workable policies to decentralize growth, to infill on vacant or under-utilized land in developed areas, and to prevent the kinds of suburbs that we have built in the past. A major goal of the City of Toronto's official plan, still before the O.M.B., is to stem the rate of office growth and to open the central areas in particular to a greater variety of activities, including housing. Metro's new plan is intended to

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1 Department of Energy, Mines and Resources, Energy Conservation in Canada op.cit., Table 8, p. 25.

2 See UDI study by Bousfield Associates and Theil Associates, Lowering the Cost of New Housing, op.cit., and Ministry of Housing, Urban Development Standards, 1976. Each of these studies was concerned with the cost of new housing; it is interesting to note that the case for energy conservation reinforces this objective.

3 We discuss the district heating process in Section C. See also Hix, "Energy Demand...", op.cit., Chapter IV, "Potential of Alternative Planning", with particular attention to the efficiency of the "grid" layout for the introduction of such systems.

support this effort with its policies of population and job decentralization, increased densities, and more or less self-contained sub-centres.[1] In smaller urban areas, energy-efficient planning principles mean that the density of new development should be at least double that which now exists (rising to at least 10 units per acre, from 5), and that new buildings should occur adjacent to existing towns, villages or hamlets instead of leapfrogging off into the countryside.

A municipality can back up its planning and zoning policies with other actions. The literature is full of ways to promote more efficient use of cars (car-pooling, establishing priorities for multi-occupant vehicles on main arteries and for parking, etc.) or the use of alternative forms of transportation (improvement of transit services, reserved bus lanes, separated bikeways, walking trails, etc.).[2] The City of Davis, California, is a model in this respect. The basic requirement is simply a willingness to get started.

What is the pay-off if municipalities follow energy-related land-use and transportation planning principles? We have seen that the townhouse uses substantially less energy than the single-family house. On the larger urban scale, there can also be savings. A study prepared for the Metropolitan Washington Council of Governments analysed six land-use development options and concluded that there would be substantial variation in energy consumption among the alternatives. The difference in the increase over base-year consumption between the least energy-consuming alternative ("dense centre") and the most energy-consuming alternative ("sprawl") was about 31%. Overall, when existing development and the predicted new increment of growth were taken into account, the difference in total energy consumption between the least energy-consuming scenario and the most was about 9%.[3]

There is little comparable data for a Canadian town or city, although one study of the Edmonton region concluded that "redevelopment" or infilling was the most energy-efficient option and "dispersed growth" the least energy-efficient.[4]

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1 Whether or not Metro can implement this plan effectively is being questioned. See, for instance, Alderman John Sewell's article, "The long-term plan for Metro commuters", Globe and Mail, February 28, 1978 and BMR Comment No. 164, "Is Metroplan a Gamble Worth Taking", February 1977.

2 See Alan Voorhees and Associates, Guidelines to Reduced Energy Consumption Through Transportation Actions, prepared for the U.S. Department of Energy Conservation, 1974. Audrey Armour has prepared "Municipal Initiatives for Energy Conservation", (Lang Armour Associates, 1977, unpublished), which documents a whole range of actions that have been taken.

3 J. S. Roberts, "Energy and Land Use: Analysis of Alternative Development Patterns", Environmental Comment, September 1975.

4 A useful summary of American and Canadian research on energy and land use is presented in Urban Form and Energy: A Selected Review, by John Chibuk, Ministry of State for Urban Affairs, July 1977.

There are several constraints on the results to be achieved through municipal planning. The obvious one is that we will still be using most of our existing urban fabric in the year 2000, when the energy crunch will have hit. Therefore refitting or "retrofitting" neighbourhoods and buildings already standing should be a subject of concern. Yet so far most research has been directed toward the conservation potential in *new* development or the *individual* building or site design. Moreover, researchers still understand very little about the *relative pay-offs in particular situations between energy-efficient new development and refitting programmes*. They can only acknowledge that potential savings will differ among municipalities according to the rate of growth, existing densities, mix of uses, and opportunities for infill. For these reasons a municipality might consider the determination of precise savings targets to be too difficult. This should not forestall action. Based on probable life-cycle costs, it seems logical to conclude that the pay-off of a compact, energy-efficient urban area, whatever the proportions of old and new stock, is inevitable as energy prices rise and more expensive fuels are substituted.[1]

Some observers regard the availability of capital financing for infrastructure improvements or extensions as a second constraint. Much of the funding for these services comes from the senior levels of government; hence, a cutback in funds, such as under the Province's spending restraint programme, or a broken promise, such as Ottawa's failure to live up to its 1975 commitment to aid urban transit, are cited as typical obstacles. Others do not agree. They argue that the problem of how to accommodate even the currently slow rate of growth in the context of financial restraint will sharpen public debate and lead to very careful planning decisions about how money should be spent. Thus they see a shortage of funds as *reinforcing* the trend toward higher densities and use of public transport. Sprawl will be the unaffordable alternative.[2]

Certainly, the municipal planning tools for regulating how land is used are widely known and available. Under The Planning Act, Ontario municipalities may prepare long-term plans (official plans), zoning by-laws, site-specific redevelopment or neighbourhood improvement plans, initiate development reviews, enter into subdivision agreements, and grant consents. Moreover, while not specifically dealing with energy concerns, the proposals of the recent Report of the Planning Act Review Committee (the Comay Report) do strengthen the role that municipal councils could play.[3]

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1 Life-cycle costing means accounting for all capital and lifetime operating costs, using an appropriate discount rate.

2 We should remember too that in the Metro situation, although not necessarily across the province, there is not as much need now for major infrastructure additions as there was 15 years ago. Thus it does not appear that capital will be a problem. Financial restraint promises to have its biggest impact on operating funds for social services, education and police —areas linked more easily to population characteristics than to land-use patterns and densities.

3 See BMR Topic No. 3, "Changing The Planning Act: Risks and Responsibilities" November 1977.

A serious constraint is the absence of provisions in The Planning Act obliging a municipal council to incorporate energy concerns both in drawing up its plans and in subsequent negotiations with land owners who wished to develop or redevelop their property. Such an amendment to the Act would mean that municipalities would carry out or cause to be carried out surveys of energy usage ("energy audits"), energy impact statements and life-cycle costing analyses in much the same way as physical, social, environmental and financial impacts are now supposed to be considered. Thus energy would become another specific consideration when planning. There is nothing in the existing Act to prevent this kind of activity; a recent study shows how one city —Oakville— could build energy concerns into its planning as part of a broader environmental approach.[1] But equally, there is no clear provision for it that would persuade a municipality to get involved or that would stand up to O.M.B. or court inquiry.

The addition of energy concerns to The Planning Act would serve another purpose: it would help to bring home the fact that the energy crisis is real. First, for the provincial government, it would imply a public commitment to energy conservation. Thus requests for additional changes in legislation or administrative practice would be given a fuller hearing. For example: funding for certain types of municipal conservation activities, or amendments to the Municipal Act if required to facilitate joint venturing or other arrangements between a municipality and a developer (to implement, say, a district heating scheme).

Second, it could help municipal government to shake off its inertia. Many we interviewed while preparing this *Topic* believe that attitudinal factors are a major reason why municipal councils and their officials have not yet made conservation a priority. The political constraint on action is real: for instance, many councils resist suggestions for changing conventional planning because of public opposition to higher densities and associated land-use arrangements. Thus at the very least, there can be broad educational value in reference to energy concerns in the Act.

Third, the Act could convince the remaining key actors in the planning process —the developers, contractors, builders, architects, planners and engineers who make up the development industry— that energy-related planning is important. Several developers in the Toronto region are already putting together "energy packages" as selling points for their individual residential or commercial properties. While they acknowledge that this acts currently as a boon to sales, they maintain that in two to three years' time conservation features will be standard in new buildings —that is, they will *have to* provide them. Not all observers are so optimistic. Many would argue that a policy framework is needed to *ensure* that the development industry will be part of the solution to the energy problem. The Planning Act and municipal planning policy are key elements of this framework. Naturally lending institutions must be willing to finance innovative proposals.

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1 See R. Lang and A. Armour, Oakville Environmental Report: A Case Study in Environmental Planning, Lang Armour Associates, 1977.

B *Building and Site Design Requirements*

Because many of those involved in conservation research and experimentation have been architects and engineers rather than planners, the available literature emphasizes the design, construction and improvement of buildings. The conservation returns in this area are more immediate and tangible than savings gained through longer-term and broader-scale planning measures. In actual fact, though, the two approaches are not separable: it is frequently hard to tell where site design or improvement ends and neighbourhood or community planning begins.

In the past, residential and other buildings have been designed at lowest possible cost, subject of course to health and safety standards. The price of energy has provided little incentive for worrying about economy in two of the most significant operating expenditures: space and water heating, which in the residential sector alone comprise 70% and 18% respectively of total energy consumption.[1] Now the life-time costs of an energy-using investment such as a building have become as important as initial costs. Thus the achievement of space and water heating efficiencies is recognized as crucial. For example, the federal government highlights three ways of reducing residential space heating demand: reinsulation of existing homes, adoption of improved building and design standards for new homes, and improved heating systems. Its studies show that reinsulation can bring about a 37% saving in existing buildings, and that improved building standards can result in a 38% reduction in space heating consumption in buildings constructed after 1975. A combination of new, more efficient heating systems, improved maintenance and retrofitting of existing furnaces, and night-time temperature setbacks would result in further savings.[2]

The quantity of literature on the potential of building design and site planning techniques for energy conservation is vast and detailed, but it is sufficient here to discuss just the common principles which emerge. While the following discussion deals mainly with residential buildings,

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1 Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., p. 17.

2 Ibid., p. 21.

many of the principles apply to commercial and industrial design as well. In fact, the savings in these sectors could be even more dramatic.[1]

i) Clustering. Clustering refers to the grouping of attached housing forms on a site to permit more intensive use of the land available. The attached housing pattern conserves energy and is more adaptable to newer technologies such as district heating. A detailed cost analysis prepared for an Oakville site indicates a 1/3 reduction in total energy costs when attached cluster housing is compared with the conventionally-located detached form.[2]

ii) Orientation. This involves positioning a building so that it can take advantage of both passive and active solar potential and at the same time be protected from wind and cold. Passive solar potential refers to the heat gain, or reduction in heat loss, that can be achieved merely by having south facing windows with, perhaps, heavy blinds or curtains that can cover the glass at night. For active solar gain, the building must be equipped with solar collectors, a heat transport medium, a storage unit, a thermostat and, usually, an auxiliary system. Either require buildings to be oriented in a north-south direction with most glass areas and doors on the south wall; this means that attached housing forms should be elongated in an east-west direction (individual units would face north-south). One study estimates that it would cost $266 to heat a new townhouse unit oriented east-west; the fuel bill for the same unit oriented north-south would be $233.[3]

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1 For instance, one analyst has shown that by controlling five simple factors in a new office building —the type and quantity of windows, the type and weight of walls and roof, the shape of the building, the infiltration of outside air, and the orientation of the building to sun and wind— an 86% reduction in winter and summer energy consumption could be achieved. That is, total energy consumption could be reduced to 14% of normal requirements. The architectural cost of the improved building need be no higher than the original one. See Karl Linton, "Case History: Energy Conservation", The Canadian Architect, March 1977, pp. 42 - 47. More conservative estimates place the potential savings at under 75%. Almost any level of savings is important for the commercial sector where, between 1962 and 1972, the rate of energy consumption increased the fastest of all sectors.

2 Hix, Energy Demand..., op.cit., p. 58. Hix argues for the placement of such clusters in linear fashion along a grid pattern to maximize servicing and transportation efficiencies as well as land use.

3 "Energy Report: Frankel/Lambert", prepared by John Hix, Architects and Planners and Karl Linton, Mechanical Engineer, for the City of Toronto, Housing Department, 1977. We show all of the estimated energy savings (based on 1979 costs) from this study on page 21.

iii) Use of natural site conditions/landscaping to reduce heating, cooling and lighting loads. This factor is self-evident and follows naturally from the orientation principle. For instance, trees can be used for windbreaks.

iv) Exterior design. A low (3- to 4-storey) square shape with well-insulated wall and roof construction is most effective in reducing winter heat loss and summer heat gain.[1] The size and placement of windows and doors is important in reducing both infiltration of outside air and conductive heat loss. Double- or frequently triple-glazing of windows, together with improved window design (for instance, shutters), also contribute substantially to the reduction in energy demand.

v) Insulation. Ceiling and wall insulation is perhaps the single most important action that can be taken to conserve energy in the existing housing stock. This has been the thrust of several government programmes for conservation to date: Ottawa operates its "Canadian Home Insulation Program", while Nova Scotia and Prince Edward Island run their own reinsulation plans. For new housing, revised insulation standards will be proposed in the national model building code that will appear later this year.

Application of these principles represents a common-sense approach to reducing energy demand and using energy more efficiently. Indeed, many were in use in Canada in earlier times, and are in use in other countries. None involves any dramatic changes in lifestyle. Savings could be increased even further by introducing some of the more sophisticated technologies (for instance, heat pumps, which can both heat and cool the air) that are now or will become feasible.

Practical demonstrations of savings through design and site planning in Ontario are few but growing. The provincial government has supported construction of a new senior citizen apartment building in Aylmer (several federal agencies were also involved), the Newmarket and Barrie court houses, and a new Consumer's Gas service depot in Toronto, all of which were designed specifically to conserve energy. Each also features a solar heating system. The Ontario Hydro Building in Toronto has been built to use only about half the energy requirements of a typical office building.

At the local level, the City of Toronto is showing initiative by developing basic energy conservation guidelines for its own housing programme. Its energy report on the Frankel/Lambert site shows the expected savings

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1 Linton, "Case History: Energy Conservation", op.cit., and studies of the National Research Council, Building Division.

on a 1,680 square foot townhouse heating bill with the addition of various conservation measures, from the simple to the more complex:[1]

Estimated fuel cost for a Toronto townhouse, 1979	$266	
Estimated fuel cost after conservation measures added:		Cumulative Saving
- orientation (no extra architectural cost)	$233	$ 33
- improved insulation (4-year payback)	$189	$ 77
- insulated shutters (8-year payback)	$138	$128
- solar storage system (14-year payback)	$ 99	$167

The City is interested in keeping the operating costs of its housing units as low as possible; about 50% of the monthly rental bill is now being claimed by energy costs, where previously it was 40%. Officials admit, however, that they still have a long way to go in bringing energy considerations into their project planning.

In the private sector, independent of any specific provincial or municipal initiatives, several developers have begun to use conservation features to attract buyers for their new houses. For instance, McClintock Homes offers a standard energy package in all its houses while Victoria-Wood intends to offer either of two energy packages as optional features in four of its development projects in the Toronto region.[2] Most of these houses are

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1 Since the townhouses have not yet been built, these savings are still hypothetical.

2 McClintock's chief features are an "energy blanket" of extra-dense insulation covering the exterior of the house frame, extra insulation in the basement and ceilings, enclosed fireplaces, double-glazed vestibules and, in the larger country houses, heat pumps. Such features are estimated to add an additional 2 1/2% to 3% on the selling price of the house. In Victoria-Wood houses, the $1,000 package will comprise seven energy-conserving measures such as extra insulation and triple-glazing; the $2,000 package will include a heat pump to reduce heat wastage.

intended for the middle to upper end of the market: Victoria-Wood's range is from $45,000 to $75,000, McClintock's from $65,000 up. The Ontario Municipal Board is currently reviewing Cadillac-Fairview's plan for energy-saving housing in March Township near Ottawa.

In the existing stock, individual homeowners have been most active in energy conservation, installing extra insulation, caulking, storm windows, and so forth.[1] Major property and development companies are making much less effort. Some are upgrading their office and industrial buildings, but very few have begun to refit their residential properties. A recent federal report notes that the absence of incentives to improve energy efficiency in rented buildings is "particularly serious".[2] Even so, one Toronto company, O'Shanter Developments, plans to upgrade and replace systems in 35 Toronto properties, 20 of them high-rise. Their motivation comes from a concern to control operating costs and maintain the value of their property investment as energy prices rise.[3]

The specific municipal role is to build reasonable energy criteria into development control policies, subdivision approvals, and the building inspection process so that potential savings will be realized in both public and private sector activity. However, there are several hindrances. Apart from the fact that more attention has been paid to building new than to upgrading existing structures, there are three main problems:

- the Ontario Building Code (1975) contains few explicit references to energy conservation, and it applies only to residential buildings, not commercial or industrial;

- there is uncertainty as to how the increased market value resulting from some conservation features will affect the assessment and hence property taxes on a building;

- few professionals, municipal officials or members of the general public as yet are paying more than lip service to energy conservation.

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1 Most of this activity probably has taken place without assistance from the federal government's Canadian Home Insulation Programme (C.H.I.P.). We understand that the take-up rate for C.H.I.P. is low, no doubt due to the facts that the application process is lengthy, the grants are small and only the insulation material itself (not the labour or the auxiliary materials) is covered under the grant.

2 Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., p. 19.

3 The company purchased these properties from other developers and attributes high operating costs not just to the price of energy but also to poor management practices and low quality of construction in the first place (for example, no wall insulation). The chief conservation measures being added are window insulation and "solar compensation" adjustments to the water system. The company intends to experiment with individual unit metering for heat and hot water and with upgrading inferior furnace equipment.

A solution to the building code problem may not be far off. The National Research Council's Standing Committee for Energy Conservation in New Buildings is drafting a model code for residential, commercial and industrial buildings, for publication this spring (1978). The overall goal is to reduce energy consumption in new buildings by 30%.[1] The main regulations will provide for increased insulation, a limit on the amount of external glass to be used as well as its positioning, controls on lighting and ventilation, and more effective temperature controls on heating and cooling systems (the big wasters). While the model code will set prescriptive standards, the Committee is also working to develop a system of building performance standards. Performance standards would set a conservation objective and then leave the designer free to choose how the building would meet this requirement.[2]

The national code will have only guideline status in relation to the Ontario Building Code. The Ontario code is the only provincial code to include any energy conservation points at all. However, its provisions are minimal (they refer just to insulation standards for walls) and apply only to residential buildings, not to all types of buildings. While the Code provides no barriers to building so that energy is saved, it offers no incentives to do extras, or penalties if they are not done. Thus it does not work as a tool for implementing conservation practices.

Revising the Ontario Building Code in accordance with the model would be a marked improvement. Even so, the new O.B.C. would cover mainly measures to reduce energy consumption and would contribute little to the development of alternate, renewable sources of energy. Zoning controls might be a more appropriate way to foster this kind of activity since they can regulate such factors as orientation, building setbacks and building heights, important in solar installations.

Several American cities have begun to deal specifically with the "solar rights" or "right-to-sunlight" issue. Los Angeles, for instance, is deciding whether new techniques (e.g. solar easements, solar districts) or just imaginative revision of existing tools (e.g. height and setback regulations) are needed, and whether plan amendments or state enabling legislation are required.[3] In Toronto, although planners recently recommended to council that no general amendment be made to the City's zoning by-law to cover solar installations, they did recognize the potential for using solar energy in infill or redevelopment projects and suggested that solar devices be favourably considered in

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1 The task of refitting is not addressed explicitly in the Code which is based on the American ASHRAE Code. In theory, consumption could be reduced in existing buildings by about 40-50%, all within a short payback period. For renovated properties, the limit beyond which the new standards will apply will have to be determined by provinces which choose to follow the Code, as is the case now.

2 For instance, a performance standard could state that "over a single year this building can use no more than x units of energy".

3 Los Angeles City Planning Department, "Property Owners' Right to Sunlight", January 1977.

applications for rezoning or minor variance.[1] The Ministry of Energy is currently examining whether there are any legal barriers to widespread applications of solar technology. Many measures to maximize the passive solar potential of a building would require no legislative change in any event, although they might involve certain modifications to street and building orientation.

A second factor working against early implementation of energy-related building and design principles may be the perceived impact on property taxes. At the present time there is uncertainty as to how the municipal assessor will treat cases where energy upgrading has occurred or solar or other innovative technologies applied. Hence, it is believed the fear of rising property taxes may act as a deterrent to energy initiatives. Several provinces are taking steps to ensure that this is not so. Manitoba conducts a "special assessment" on houses equipped for solar heating and pays the differential to the municipality; Nova Scotia has announced its intention to protect owners who reinsulate *or* install any alternate energy system such as solar, wind, or heat pump. In Ontario, Ministry of Energy officials are just completing their examination of the potential property tax implications of solar and other technologies. There are two questions: a factual one —will property taxes rise?— and a policy one —should any special exemptions be created? There are, of course, a number of other incentives that must be considered alongside property tax relief, such as grants, low interest mortgages, and consumer protection services.[2] Thus the issue is: if property taxes do indeed act as a deterrent, then what is the most direct and equitable way of offsetting this effect?

The third obstruction to an early and widespread start on energy-sound building and design practices is attitudinal. The absence of a strong public commitment to energy conservation is probably the single most important constraint on achieving reduced consumption and greater efficiency in energy usage. Yet by taking the decision to act, through planning policies and through design incentives and regulations, a municipality surely *can* help to bring about appropriate changes in attitudes and behaviour —on the part of the development industry and the general public as well as provincial and federal authorities, which can provide some of the financial and legislative

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1 City of Toronto Planning Board, "Solar collectors on dwellings in new residential areas", Report to Committee on Buildings and Development, November 14, 1977. The City of Ottawa recently passed a resolution to the effect that space and water heating efficiencies for new development will be actively pursued. This includes a review of municipal powers existing or required to encourage the immediate implementation of new systems or the conversion to them at a later date.

2 For a discussion of the implementation problems surrounding solar energy, see M. K. Berkowitz, Implementing A Solar Technology in Canada: The Costs, Benefits and Role of Government, University of Toronto, Institute of Policy Analysis, May 1977.

leverage required. This decision is imperative: while the energy bandwagon has started rolling, the commitment to conservation is tenuous. The federal government has spent just 15% of its 1977/78 research budget on conservation and renewable supplies. The Ontario government is proceeding slowly and cautiously. The development industry wants conservation to be profitable in both the short and the long term. And municipal government itself is still pre-occupied with balancing this year's budget.

C *The Development of New Energy Supplies*

Can municipalities develop new energy supplies? Why should they? The municipal level now has little control over the nation's energy supply. It is, however, a major end-user of energy. Therefore it must be concerned with the availability of energy and with the economy and efficiency of its use. Further, as part and parcel of a conserver approach, the municipal level should be legitimately concerned for the development of appropriate technology and a reduction in the vulnerability of its jurisdiction to price escalation, shortages, and so forth.

"Alternate" energy supplies is the term usually applied to renewable sources that are substitutes for or supplements to conventional fossil fuels or nuclear power. Renewable sources and the associated technologies have a benign or even positive effect on the environment and on social and economic organization. Examining just Ontario Hydro's long-term plans, a recent study reports that, by relying on renewable energy sources, innovative energy systems and, of course, insulation and other conservation measures, we could sufficiently reduce our demand on the central electrical system by 1993 to allow postponement of the next four projected nuclear plants. At a minimum this would mean less pressure on the provincial borrowing capacity, and more time for Hydro to deal with the nuclear waste problem.[1]

Opportunities for municipal energy supply include: recycling and resource recovery, district heating and cogeneration, small-scale hydraulic generation, and solar power. Quantifying the direct and indirect benefits of these actions is harder than calculating the savings achieved through, say, energy-efficient building practices. Nevertheless, *many analysts are enthusiastic about the potential offered by alternate energy supplies for reducing our dependence on conventional fuels*. The technologies are now feasible or will become so once markets are created. To a great extent the creation of markets depends on attitudes, expectations and institutional arrangements, all of which frequently resist change.

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1 See "Hydro's need for 4 nuclear plants questioned", Globe and Mail, January 9, 1978. The report, Alternatives to Ontario Hydro's Generation Program, was prepared by Peter Middleton Associates for the Royal Commission on Electric Power Planning, January 1978.

Recycling and Resource Recovery

Municipalities generate large amounts of consumer solid waste —on average three pounds per person daily.[1] Metro Toronto alone currently produces two million tons a year. In the past municipalities have used landfill as their primary means of disposal. This method is no longer satisfactory: the costs of haulage are rising, the method has serious environmental effects, there has been opposition from communities living nearby designated landfill areas, and there is a competing demand for sites from urban and rural uses. Thus municipal government has been pushed to look to recycling as an important and necessary alternative to current waste disposal practices.[2] Now that the energy crunch is starting to be felt, the energy advantages of recycling are also attractive. Thus recycling combines solutions to the waste management problem with opportunities for energy production.

Recycling is the processing of solid wastes to recover original raw materials such as the fibre content of waste paper, or the steel content from cans. Associated with the concept of recycling are resource recovery and waste reduction. *Resource recovery* refers to any productive use of what would otherwise be a waste material requiring disposal and new energy to manufacture the original product. *Waste reduction* is concerned with finding ways to reduce the need for extracting large volumes of new materials in the first place. Each implies a change in consumer behaviour and attitudes.

The federal government is enthusiastic about the potential for savings in energy through the reclamation of valuable materials and the recovery of energy by burning combustible wastes.[3] For instance, steam plants can be refuse-fired, old newspapers can be used in the production of insulation, and recycled glass can be used in asphalt production. Because recycled materials can be sold for use as a substitute in or additive to other products and processes, recycling can allow towns and cities to recover at least part of their refuse collection costs.

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1 Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., p. 40. If one adds agricultural, mining and industrial wastes, the per capita total is 140 pounds per day.

2 Even with recycling it is important to note that landfill will continue to be significant as a disposal technique for non-recyclable wastes and for residues from facilities using the processed wastes. For a discussion of waste management see BMR Comment, No. 142, "Recycling: Why, When, and How", August 1973, and No. 151, "The Politics of Waste Management", January 1975.

3 Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., p. 40. If recycling were to become a common practice, the use of secondary materials could have a direct impact on the need for virgin resource extraction. However, waste incineration to produce heat or electricity is a much closer reality than full recycling.

The Science Council states that, simply by better recycling and resource recovery, a typical community of 100,000 people could save up to 3.5 million gallons of fuel per year.[1] About 84% of solid waste material is recyclable; the figures below show the composition of refuse from the City of Toronto:[2]

Combustibles		Noncombustibles	
Paper and Cardboard	39.5%		
Food Waste	32.4%		
Vegetation	6.5%	Glass	8.0%
Plastic	2.6%	Cans	5.5%
Rags	1.5%	Metals - Ferrous	0.3%
Wood	1.1%	- Non-ferrous	0.1%
Other Misc. Combustibles	1.1%	Other Misc. Noncombustibles	1.4%
	84.7%		15.3%

Total Sample 100.0%

Yet current estimates for Ontario are that less than 1% of municipal solid waste undergoes any type of recycling.

European cities are far ahead of both Canada and the U.S.; they have been managing recycling programmes for the past 20 years. There are about 180 recycling plants operating or under construction in Western Europe, nine times as many as in the U.S.

Some 90 American cities of all sizes are now considering recycling plants, ranging from 20-ton per day systems to a 2,000-ton per day system proposed for the City of Chicago. One system frequently cited is the City of Milwaukee's Americology recycling plant. When in full operation this is expected to receive *all* of the City's annual 250,000 tons of solid waste (population 700,000) and convert 90% of it into recoverable resources such as metals, paper, glass, etc.[3] The refuse-derived fuel produced in this process is used by the Wisconsin Electric Power Company in supplementing coal-fired boilers to generate electricity.

While this scale of recycling plant is considered feasible for Canada, it would have to be located in urban centres which generated sufficient volumes of solid waste to ensure economic feasibility. The Province is now studying the feasibility of recovery plants for smaller communities, using the Town of Lindsay (population 13,000) as a test case. (A plant with a capacity of up to 50 tons per day is being considered.) Smaller communities could also participate in a recycling scheme by establishing local transfer stations from which waste materials were transported to a large, centrally-located plant.

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1 Additional savings would include 30,000 tons of paper and cardboard, 3,600 tons of ferrous materials, 700 tons of aluminum, lead, zinc and copper, and 4,000 tons of glass. See Science Council, Canada as a Conserver Society, op.cit., p. 53.

2 Study Team on Watts from Waste, Interim Report to the Ministry of the Environment, July 1973, p. 7.

3 One recycled product from this plant is the fertilizer MilOrganite —selling as far afield as Toronto for about $6.00 a bag.

There are several experimental recycling programmes in Toronto.

- The "Watts from Waste" programme now in its final design stage, will produce a refuse-derived fuel to be burned in conjunction with coal at Ontario Hydro's Lakeview Generating Station in Etobicoke. This project was established by the provincial government in 1973 to examine in detail the feasibility of using specially prepared refuse as a fuel in power generating stations.

- The Ontario Resource Recovery Centre in North York, funded two-thirds by the Ministry of the Environment and one-third by Metro, is operating in its first stage as a transfer facility, with full processing operations scheduled for Spring 1978. The plant is designed to handle up to 1,200 tons of residential and commercial solid wastes per day. One of the research purposes is to assess the market potential of recycled products. This project will also permit a more accurate determination of capital and operating costs and how these vary by plant size and type or specific area requirements.

- The Ministry of the Environment is setting up a further project in cooperation with the City of Toronto, Etobicoke, Georgetown and Aurora to determine the effectiveness of source separation of waste materials. The municipalities will provide the collection service and in return receive the revenue from the sale of recycled products.

- The Toronto Recycling Action Committee (TRAC), established by the City of Toronto in 1973, operates a recycling depot for glass and metal waste products. A newspaper collection service is provided weekly.

- The Is Five Foundation is a private Toronto-based group established in 1975 with L.I.P. funding to look into three areas: solid waste management (for instance, the feasibility of source-separated collection), public education, and citizen participation. Is Five provides recycling facilities in areas of Toronto where this service is desired but presently unavailable, and is organizing a Recycling Council of Ontario for all non-profit groups involved in recycling.

An important barrier to widespread use of recycling processes is the underdeveloped state of the market for recycled products. In the absence of widespread encouragement for business, industry, households, and governments themselves to use more secondary materials, there is little demand for recycled products. Hence there is little incentive for private businesses —scrap dealers and haulage companies as well as manufacturing industries— to become interested. With expected increases in energy, landfill, and raw materials costs, the economics of recycling and resource recovery are likely to change. By undertaking to use recycled paper and other reprocessed products in municipal operations, a municipal council can contribute to the early development of markets.

A local council seeking to go further by promoting energy recovery from its waste collection programme will run up against the high capital cost and risk of a recovery plant. This situation will improve as technology and markets develop. But for recycling to become a widespread reality, municipal initiative alone will not be sufficient. Jurisdictional obstructions will have to be removed. Grants, loans and tax concessions from senior levels of government will encourage risk-taking. And the willing participation of a whole variety of private sector actors, —large corporations, small businesses, and manufacturing concerns— is essential.[1]

The fact that we are still very much a consumer, throwaway society presents a third obstacle to effective recycling, but one which municipal government action can help to remove. By promoting at-source separation of garbage and separate collections, or by instituting waste depot systems, a municipality can provide the essential leadership toward full-scale public and private recycling programmes. This presumes that a municipality will also take the lead in encouraging waste reduction in the first place. This might be done directly through a public educational programme. Other actions such as design regulations and bans on certain materials would require legislation by senior governments.

A note on *biomass conversion:* just as solid wastes can be used for fuel or reprocessing, so also organic wastes, including sewage, forestry, or crop wastes, can be converted to a biogas or a synthetic liquid fuel such as methanol. The variety of processes by which this can be accomplished fall under the general heading of "biomass conversion". Conversion products can be used as fuel substitutes for natural gas or as gasoline substitutes or additives for powering internal combustion engines. There have been many practical applications of biomass conversion, notably in wartime Europe to power cars and transport vehicles when oil supplies were interrupted. Toronto's Humber sewage treatment plant now reuses the products of an anaerobic digestion process in its internal operations. However, in terms of widespread application, there are still problems involved with the collection of wastes as well as with the technology and economics of production. Most analysts believe that biomass conversion has potential but stress that it should be regarded as a longer-term possibility. It would be particularly suitable to a variety of small-scale municipal applications. For some smaller communities, such as those living close by lumbering operations, biomass conversion might be a more flexible and useful alternative than recycling. "Dedicated biomass" refers to crops or trees grown specifically for energy conversion —a rural municipal option.

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1 One recent study cites the involvement of private sector resource recovery companies as the "key difference between the flourishing European models and the fledgling American industry". For a summary see "ERDA study points to industry, bid process as key to Europe's resource recovery success", by C. Johnson in Reports of the National Solid Wastes Management Association, 12(12), December 1977, p. 4.

Integrated Energy Systems: District Heating and Cogeneration

District heating involves the provision of space heating or cooling or industrial process heat from a central source to surrounding industrial, commercial or residential communities.[1] It is compatible with several of the municipal energy strategies discussed earlier, from reducing sprawl and infilling on underutilized land to recycling wastes and recovering waste heat energy. The system may use waste heat from local industries or an electrical generating plant, heat derived from an incinerator burning combustible municipal waste, or conventional sources of fuel (oil, gas, or coal). The energy is usually transmitted by hot water or steam. The objectives of a district heating system are to provide energy at lower cost with less waste and greater efficiency than direct use of a fuel in individual systems.

District heating is not a new concept. There are numerous proven examples in Europe, where central heating plants have been operating for over 20 years. There has been no widespread application of central plant heating in North America and those systems that do exist are comparatively small-scale, or by now, outmoded. In recent years, however, there has been a resurgence of interest in developing modern district heating systems in Canada. The City of Toronto, for instance, is proceeding with its plan to integrate and expand its existing systems into one operated by a single district heating authority.[2] Among the benefits of integration are the conservation of fossil fuels, a reduction in air pollution, and the provision of additional capacity to allow the system to take on more customers. Once the existing systems have been linked, steam heat will be provided by a new refuse-fired incinerator. In Ajax, Ontario, a committee of municipal officials and citizens is also looking to a refuse-fired plant as one option for replacing the existing fossil-fuelled heating system which serves a number of residential, institutional and industrial users.[3]

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1 Two concise references on district heating and cogeneration are Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., pp. 42 - 44, and E. L. Morofsky, "District Energy Options", Urban Forum, November - December 1977, pp. 10 - 19.

2 The existing system comprises several Toronto hospitals, University of Toronto, Queen's Park, and Toronto Hydro's Pearl Street and Teraulay Street plants. See Toronto District Heating Study, Summary and Policy Report, December 1973. The new plan is now at the detailed agreement stage.

3 The operations of Industrial Steam Limited of Ajax are becoming uneconomic because of the increased costs of fossil fuels and new provincial regulations for pollution control. The ability of the Region of Durham to supply refuse, thereby reducing its own landfill requirements, is one reason why a refuse-fired plant looks attractive at this stage.

There are two prerequisites for district heating. First is the existence of subscribers with a heat demand, whether the system is to be applied in an old or a new urban area. Second is the coordination of planning and finance between all actors in the system —municipal authorities, public utilities, senior governments, private industries and users.[1] District heating studies being prepared for Halifax, Ottawa, Winnipeg and Edmonton will assess the feasibility of proceeding with demonstration projects involving all levels of government. A recent report has concluded that, in Ontario, district systems using refuse incineration or waste heat from electrical generating systems could play an important role in an overall provincial energy strategy.[2]

In light of European experience, we also know that combined electric power and heating plants can be feasible. The City of Malmö, Sweden, operates *both* combined and central heating-only systems. The process of producing electricity and utilizing the by-product heat in the form of steam or hot water is sometimes referred to as *cogeneration*.

Cogeneration is a process which so far in Canada has received mainly industrial applications, especially in the pulp and paper and petro-chemical industries. In most cases it involves the generation of electricity from industrial process steam. This electricity can be used by the industrial plant itself or made available for distribution by the local utility company. The major advantage to the plant owner is higher overall thermal efficiencies that can protect against rising power costs and, in some cases, ensure against interruptions in main power supply. Taken one step further, the heat that might normally be lost in the generation process can be recovered and used locally for space or process heating purposes, or in a district system to heat nearby housing.

In Ontario there is growing interest in the potential for reducing demands on the central electrical system through industrial cogeneration.[3] Some view the potential benefits of cogeneration as even broader. The Hearst

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1 In Toronto's case, the Council has provided funds for integrating the system; although funding for the new $60 million plant has not yet been arranged, several private companies have expressed interest in constructing and operating the plant. The company would charge for refuse disposal and for the provision of steam.

2 See Middleton Associates, Alternatives to Ontario Hydro's Generation Program, op.cit., Chapter IV and p. 160.

3 One study estimates that by-product electricity generated in conjunction with the raising of industrial process steam requires about half as much fuel as electricity generated in a conventional power plant. See Report on Industrial By-product Power, prepared by Leighton and Kidd Ltd. for the Royal Commission on Electric Power Planning, May 1977.

Wood Waste Energy Study recommends building a wood residue-fired thermal generating complex to utilize waste from surrounding lumbering operations (thereby solving existing disposal problems) and to produce electricity and steam.[1] The steam would be sold to several local concerns to replace natural gas for heating purposes and the electrical power would be sold to the Hearst Public Utilities Commission. In addition to the energy savings, the report predicts a beneficial effect on employment and the economy of the Hearst region.[2] Ownership and management of the complex remain to be worked out.

The federal government has acknowledged that the potential for cogeneration is significant and yet largely unexplored. It has called for demonstration projects of cogeneration as well as district heating.[3] Such projects can offer a municipality the opportunity for both reduced dependence on conventional energy supplies and the development of local ones, particularly waste incineration. The size of a community and the mix of users are important aspects of feasibility. For any given situation, then, a cost-benefit analysis is necessary, with initial capital costs evaluated against longer-term social, environmental and energy costs and benefits. Front-end capital has to be found.

Where electricity is to be generated and used locally, or perhaps even supplied to the provincial grid, there are some special institutional considerations. Given our system whereby Ontario Hydro is the main producer and distributor of electrical power, how can we best reconcile local-scale and system-wide views? That is, how can we best ensure the reliability of power supply (for both Hydro and the users depending on local generation when, say, the plant shuts down for maintenance), the technical compatibility of small-scale and larger-scale systems, and equity in the allocation of production costs?[4]

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1 A joint project of several provincial ministries, Ontario Hydro, the Town of Hearst, and the Hearst Lumberman's Association, with Acres Shawinigan Ltd. as consultants.

2 In addition to construction jobs for the local labour force, there would be 30 permanent jobs, jobs created in the associated industries such as haulage, the possibility of new industries locating so as to take advantage of this new source of heat and electricity, and savings on disposal costs.

3 Department of Energy, Mines and Resources, Energy Conservation in Canada, op.cit., p. 42, 44. The government has created a new 50% capital cost allowance tax class for certain equipment required.

4 Under existing arrangements, Hydro builds large plants to meet growing energy demands (the "baseload"). The cost questions are complex, for instance: from Hydro's viewpoint, what rate should it charge a local utility or industry which requires only standby power —the average cost, based on the total system, or the marginal cost? What price should Hydro pay for local surplus electricity?

Small-Scale Hydraulic Sources

While at one time many Ontario towns and cities generated their own hydraulic power, now there are only a few. The expansion of Ontario Hydro and the beginning of large-scale power generation, coupled with rising demand, soon made local hydraulic generation uneconomic. Now municipalities are having to face the prospect of disruption and extra servicing costs due to the location of large coal-fired or nuclear power plants nearby. Further, in view of the overall energy situation, diversification of supply options seems wise, from both a local and a province-wide viewpoint.

Hydro-power is renewable, uses established technology, and is non-polluting. There are many potential sites for small-scale power generation, particularly in northwestern Ontario. From Hydro's viewpoint, most of these sites are too expensive to develop, although they will become increasingly attractive as costs of both fossil fuels and nuclear production rise. Procedures for operating some stations by remote control have improved the overall economics. Moreover, the economies of large-scale plants are no longer as clear as they once were. Quoting from Hydro's own studies, one recent report shows that the development of certain small hydro sources is already cost-competitive with some of Hydro's fossil-fuelled stations.[1]

There is a strong rationale for municipalities with hydro potential to take the initiative in developing workable proposals. The Public Utilities Act clearly authorizes municipal action. The municipal level might be better able to assess the local feasibility of a small hydro project, taking into consideration such factors as the economic and environmental effects. Even small power dams can cause undesirable flooding, the relocation of roads, loss of agriculture, forestry and other means of livelihood. Moreover, given Hydro's and the provincial government's pre-occupation for the foreseeable future with nuclear technology, there might be a greater chance that suitable hydraulic sources would be developed. The electricity generated could be used locally, or perhaps sold to the provincial grid. There are financial, administrative and jurisdictional arrangements to be worked out, just as with cogeneration.

Solar Energy

The sun is the original energy source, the basis of all life on earth. Solar energy seems to be an ideal source —it is abundant, non-polluting and, given its capacity to heat water to about 180°f, well-suited to meeting our heating and cooling needs. In Canada we use roughly 55% of all our energy in the form of low-grade heat for such purposes as space and water heating.

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1 See Middleton Associates, Alternatives to Ontario Hydro's Generation Programme, op.cit., Chapter IV and p. 159, and Hydro's submission to the Royal Commission on Electric Power Planning, Final Hearings: Generation: Non-nuclear, May 1977.

Thus solar power could satisfy a major part of our energy demand. More sophisticated applications such as solar electricity or the use of solar energy in the sewage treatment process may also become feasible.[1]

If solar energy is an ideal source, then why has it not yet been applied on a large scale? There are two basic problems: the technological and economic feasibility of solar power, and the institutional and legislative framework required. The two are inter-related.

The technical problem arises out of the fact that, although sunshine is abundant and free, it is also diffuse and needs to be collected —by collectors with a sufficiently large surface area to trap the sun's heat. Further, since sunshine is intermittent, this collected solar heat must be stored in water, rocks, or other media. The collectors and storage systems developed so far are expensive to build, install and maintain. Hence, the availability of skilled expertise and competitive low-cost components has been a major constraint on harnessing solar energy.

Of course much can be done to develop the passive solar potential of new buildings; some architects believe the most cost-effective option currently available is passive solar gain with a heat pump and small water storage system. For older buildings it may be more cost-effective to reinsulate than to fit solar panels onto rooftops. But even with regard to building complete solar systems, most experts agree that, through expanded research and use, reliable performance of solar technology can be achieved in the near future. Moreover, as fossil fuel prices rise and solar installations become more common, the cost considerations which have discouraged the harnessing of solar energy on any significant scale should diminish. It is estimated that a large market of up to $6 billion in sales can be developed for solar collectors in Canada by 1990; this in turn would lower manufacturing and selling costs.[2]

The Science Council reports that over 50 solar units were installed in Canada by 1977; this number is expected to rise to 250 or 300 units by 1978.[3] In Ontario numerous experimental projects, both government and private sector, have been completed or are in the planning stage.[4] Although widespread

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1 Ontario's Energy and Environment ministries are engaged in a joint project to determine solar energy applications in the sewage treatment plant process. They expect to report by the end of March 1978.

2 Science Council, Canada as a Conserver Society, op.cit., p. 57. Note that over 120 individuals and businesses are now providing services in solar space, water, or pool heating. See Ron Argue, "Renewable Energy for Ontario", op.cit., p. 57. Argue anticipates cost reductions of up to 50% within a few years as the market develops.

3 Science Council, Canada as a Conserver Society, op.cit., p. 48.

4 For a description of these solar projects, see Turn on the Sun, Ontario Ministry of Energy, September 1977.

application of solar technology is likely to occur first in new multiple-unit residences and commercial and institutional buildings, at least one community in the north is looking to solar energy to permit the continuation of a preferred lifestyle. The Serpent River Indian Reserve at Cutler, Ontario, is studying the viability of a solar heated farm building with an attached greenhouse. They have assessed their own energy needs and believe that solar energy in the near future could supply power for all domestic heating and all current small-scale industrial enterprises.[1]

The institutional/legislative problem in adopting solar technology in Ontario is best appreciated by comparison with the U.S., where the implementation of solar energy appears further advanced. Notwithstanding climatic differences, this can be attributed in large part to the promotional role that all levels of government in the U.S. are playing. At the national scale, President Carter's proposed energy plan contains a number of bills aimed at encouraging solar installations, with the objective of having 2.5 million solar-heated American homes by 1985. State legislation has gone further, with all but three states having enacted or proposed at least one law designed to foster solar energy. Much of this legislation has taken the form of tax incentives.[2]

At the local government level, cities and towns have taken steps to install solar equipment in public buildings, guarantee so-called "sun rights", and formulate property tax exemptions for those who install solar energy systems. The model town for solar energy is Davis, California, where the City has developed an Energy Code to regulate the design and orientation of buildings, type of construction materials, and other building practices and in addition is constructing several prototype housing units to demonstrate to developers, local builders, and the general public the methods of active solar heating and cooling.[3]

How the solar rights issue should be resolved in Ontario is not yet clear. For instance, the City of Toronto's cautious report on zoning changes to promote solar installations, noted earlier, was based on the difficulty of retrofitting built-up areas. Others we have spoken to de-emphasize

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1 T. Jackson, "Demystifying Energy Choices: Alternatives North of 50", Bulletin of the Canadian Association in Support of Native Peoples, 18(2), 1977. See also "Solar heating could help Indians, study says", Globe and Mail, January 21, 1978.

2 See "Solar Legislation" in Solar Energy Handbook, by Popular Science, 1978. Carter's proposed legislation includes income tax credits for all or partial costs of solar installations, low interest loans for homeowners and builders to pay for solar equipment, loans to farms and businesses, solar installations on federal buildings and solar demonstration projects.

3 See The Davis Experiment, op.cit..

the retrofit problem, saying it requires mainly imaginative planning. The Ministry of Energy is currently examining the legislative aspects of solar system implementation, studying, for example, the extent to which shading is likely to be a problem. To avoid duplication of effort, municipalities should cooperate with the Province on this issue, bring forward proposals for revamping building codes or zoning by-laws, and lobby, if necessary, to institute these and other changes.

There are several additional areas for municipal action if solar energy is to be developed as a viable alternate supply:[1]

- begin to incorporate solar energy systems into public buildings, including municipal offices, schools and libraries;

- encourage developers to use solar systems wherever possible in residential, commercial and industrial projects;

- pressure the senior levels of government for financial incentives to businesses, individuals and builders in an effort to promote solar installations;

- lobby the senior levels of government for a greater allocation of research and development funding to solar energy (and other renewables). At present the support given to researchers in the petroleum or nuclear industries is by far disproportionate to that given to researchers in the softer technologies.

We should bear in mind that several large government or development industry orders for solar equipment would go a long way toward overcoming both the technical and legislative constraints on the development of solar energy.

D *Promoting Conservation and Renewables by Demonstration and Education*

All of the initiatives discussed so far in this *Topic* depend on a basic commitment by a municipality to do its part for the energy problem. In this last section we look at how a municipality can promote a conserver approach by setting an example and by educating local consumers. We outline four areas. A municipality has the opportunity to:

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1 Based on analysis contained in Hooper and Angus Associates, Legislative and Governmental Actions Bearing on the Development of the Solar Heating Alternative, prepared for the Royal Commission on Electric Power Planning, January, 1978. See also Bezdek et al, Analysis of Policy Options for Commercialization of Solar Heating and Cooling Systems, George Washington University, 1977.

— develop an internal energy management programme aimed at reducing demand and improving the energy efficiency of its own buildings and operations;

— participate in and sponsor demonstration projects to show the potential of all types of energy measures;

— provide information which will enable individuals, groups, business leaders, developers, architects, engineers and planners to make energy-wise choices;

— ensure that the local utility plays a full conservation role. Although not "municipal government" in the sense that we have used throughout this *Topic*, public utilities are municipally elected bodies and therefore are accountable to the local community.[1]

An Internal Energy Management Programme

There are two distinct benefits which can be derived from a municipal energy management programme: significant dollar savings for municipal councils and school boards at a time when they are facing rising energy prices and tightened budgets, and the setting of an important example which can educate and motivate the general public to conserve energy.

A successful energy management programme has five key elements:

— *a commitment* to participate in an energy conservation programme, enunciated in a clear statement of realistic objectives.

— *an energy use and cost information system*. To determine where energy savings can be made the municipality or school board should keep appropriate records of energy usage, for instance, by building, by vehicle type and by department. Thus, one of the first steps towards implementing an energy management programme would be a systematic survey or "energy audit".

— *use of life-cycle costing techniques*. Because cost is an obvious consideration in decision-making and priority-setting, public officials need to be able to measure the real cost and benefits of investments. Life-cycle costing is a technique which measures the capital and operating costs of an item or system over the expected life of the investment in present-day dollars and permits the comparison of one energy-using purchase with another.

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1 There are over 350 elected utility commissions in Ontario. There are several exceptions, such as Toronto and Ottawa, where the commissions are comprised of municipal and provincial appointees. The responsibility of a municipal utility is divided: while the utility is accountable to the local community, Ontario Hydro regulates the utility's rate-setting, borrowing, and construction of facilities.

— *a plan to reduce energy consumption*, made up of specific programmes and energy-saving measures designed to achieve the objectives.

— *a monitoring and evaluation system*. For the programme to be effective, municipal councils and school boards must be able to measure the results, in terms of reduced consumption and of dollar savings. It will be important to the long-term success of the programme that civic employees and the public know whether the measures are working. Therefore, results of the accounting, monitoring and evaluation process should be publicized periodically.

It is not our intention here to provide a checklist of the myriad of energy-related measures which a given municipality might select. Reports, guidebooks and pamphlets outlining ways to save energy and dollars are in good supply. The federal government has its own internal energy conservation programme ("Save 10") intended to reduce its total energy consumption by 10 per cent from the 1975-76 level (an expenditure reduction of about $30 million) and hold that level of consumption for 10 years. Ottawa is also funding the preparation of a detailed handbook on internal energy conservation programmes at the municipal level. This handbook is due for publication in mid-1978.[1]

Recent efforts by Ontario school boards demonstrate the kinds of savings in both fuel and money that can be garnered through just simple "housekeeping" measures such as reducing temperature levels and adding weatherstripping. The Simcoe County Board of Education has experienced significant results with its energy management programme and is looking at other areas of potential reduction in energy use. The Board's Energy Management Committee reported in late 1977 that in the 30-month period from January, 1975 to June, 1977, their programme had saved 15 million kilowatt-hours, equivalent to 300,000 gallons of oil and representing a 5 per cent overall reduction in the total energy used during the period. The estimated value of the saving is $180,200. Other school boards which have reported reduction in overall use are the London Board of Education and the Halton Board of Education. In Halton's case, the Board claims that it achieved more than a 20 per cent reduction in total energy use in 1976 by means of simple operational measures such as turning off ventilation fans after school hours and reducing lighting levels.[2]

There are several ways that a municipal energy conservation programme can be developed and managed. The federal government's forthcoming manual, will deal with some of them, such as: a) focussing responsibility in a special

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1 Researcher Ray DeBlasi is preparing the handbook under contract from the Department of Energy, Mines and Resources, Office of Energy Conservation.

2 An energy management committee was formed in the fall of 1977. It will be sending out regular directives to all principals and caretakers requiring them to undertake various conservation measures. Energy-efficient architectural guidelines for new buildings have also been drawn up. The Halton Board was prompted to act as a result of both rising energy bills and an educational programme organized by the Ministry of Education's energy committee.

energy staff agency, b) establishing an ad hoc energy conservation task force, c) assigning responsibility to an existing department (such as budget or engineering) or, d) to a single staff person acting as an energy coordinator with all department heads, and, e) assigning responsibility to each department head with the coordination of activities being done by the Chief Administrator's office.

In the case of Metro Toronto the latter approach would seem to require the least organizational change, but naturally the most suitable method for managing such a programme would vary according to the size and structure of each municipality.

Demonstration Projects

A municipality could sponsor demonstration projects, or be a joint sponsor with independent groups, research organizations like Energy Probe, or university and college departments, to test the potential of a variety of energy-saving measures, ranging from insulation and lower lighting levels to improved building design concepts to waste heat recovery systems and solar energy installations. The Science Council has suggested that a selected number of community colleges across Canada be assisted in setting up "Arks" similar to the one in Prince Edward Island.[1] While few would suggest that the sophisticated Ark or Provident House, north of Toronto, will ever receive widespread application, these projects are valuable as combined research and teaching laboratories for the development of appropriate technologies. Funding some demonstration projects would necessarily rely on grants from the federal and provincial governments and from business and industry. A municipality could assist in the search for funding, lobbying when necessary. Depending on the project, a municipality could also cooperate by departing from conventional administrative practices or by providing sites or access roads.

Information Services

Information, advice and perhaps technical assistance would encourage people to both change their consumption habits and improve energy efficiency in their own homes and offices. Much information has already been put together by the provincial and federal governments or by groups such as Energy Probe, covering such topics as:

- which appliances are the worst offenders and how to use appliances more efficiently;
- how to buy, drive and maintain cars to reduce the amount of fuel used (pointing out the enormous savings possible if people drove less);
- how to set up car pools;

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1 Science Council, Canada as a Conserver Society, op.cit. p. 81.

- the importance of insulation and how to insulate properly; the benefits of storm windows, caulking, etc.;
- the importance of separating refuse into recyclables and non-recyclables, and of reducing the amount of waste in the first place;
- how to think in terms of life-time costs rather than initial price tags.

A municipality could promote these publications by helping to distribute them (in schools, libraries, in municipal offices) or, better still, by backing up suggested measures with specific actions —for example, setting up a municipal recycling programme or developing a parking policy that would encourage car pooling. In considering municipal involvement in consumer education, however, we must remember that frequently the local utility is much better placed to provide these services effectively.

A Strong Role for the Local Electric Utility

There are two basic requirements for conserving electrical energy: consumers must use less, and the peak demands, both daily and seasonal, must be evened out.[1] Given these requirements, there are several opportunities open to the municipal utility: establishing a consumer information programme, implementing load management and pricing policies, and generating electricity from local sources.

The *minimum* role a utility could play would be to mount an educational campaign directed at reducing consumption in the commercial sector, which is growing fastest and wasting most energy, and in the domestic sector. Stuffing hydro bills with consumer information or revising billing formats to show how electricity is used and the cost of this usage could raise customer awareness of wasteful consumption habits.

Most Ontario utilities now cooperate with Hydro in the preparation and distribution of consumer literature. Only a few —notably, Welland and North York— have developed their own aggressive conservation programmes aimed at convincing local consumers that they have a part to play in solving the province-wide energy problem. In view of an inadequate level of public sensitivity toward the need for conservation, the opportunity for utility initiative is wide open. The direct benefit to the utility would be lower billings from Hydro.

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1 Using less means total consumption (kilowatt hours) is reduced. Smoothing out the peak periods means that system capacity (kilowatts) need not grow so fast. Thus, in the short term, reliable service can be maintained even with lower generating reserves and, in the long term, planned generating capacity (i.e., new generating stations) can be reduced.

"Demand management" requires the utility to undertake a more interventionist role. The term refers to measures adopted by an electrical utility to shift some consumption from periods of high total system demand (usually, during the daytime and early evening) to periods of lower demand in order to more efficiently utilize the existing generation, transmission and distribution facilities. Usually this is accomplished through a combination of pricing policies ("time-differentiated rates") and direct load control measures.

Demand management is not new, either at the bulk power supply level (Ontario Hydro) or at the local distribution level. For instance, Ontario Hydro has supplied power on an interruptible basis to about 20 of its direct industrial users for many years[1], while several local utilities, notably North York and Toronto Hydro, have implemented water heater controls as a way of reducing peak loads and, hence, their own power bills from Ontario Hydro. Since neither Hydro nor the local utilities have developed any peaking surcharges or time-of-day features in their tariffs, comprehensive demand management programmes have not been introduced at either level. Until recently there has been no incentive to do so.

Since its inception in 1906, Ontario Hydro's mandate has been to generate and transmit power at the lowest cost consistent with safe and reliable service. In carrying out this mandate, it has encouraged consumption in order to obtain economies of scale that translate into lower unit costs. This remained Hydro's policy right up to the late 1960's, early 1970's. Since these costs must be allocated among the users of electrical power, Hydro has attempted in setting its rate structures to create an equitable distribution of costs across its various customer classes.[2] The general pricing system used is common to most North American utilities and is based on the average cost of production (averaged over all generating plants, as opposed to marginal cost, which reflects the cost of producing additional energy from new plants) and on a descending or declining block rate (so that electricity is cheaper the more it is consumed). The former has the effect of increasing peak demand; the latter is widely perceived as promotional of energy use.

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1 Interruptible power is viable for industries that can discontinue using certain equipment if required. In fact, the power to these industries has been interrupted rarely.

2 There are two main classes of Hydro customer: the bulk purchasers, including municipal utilities and about 100 large industries, and the retail purchasers, which include some 800,000 rural customers —houses, farms, cottages, and small industries. Within each class there is great variability with regard to level and amount of power consumed, and rates vary accordingly. Large customers, including municipalities, pay both an "energy" charge and a "demand" charge. Retail customers are billed on a descending block rate. Local utilities negotiate with Hydro the rates (based on a descending block rate structure) they will charge their own customers.

The logic of this system has worked against conserving electricity by means of demand management. Hydro has focussed on economies of scale, which can be achieved only if demand increases. Municipal utilities for the most part have found little benefit in shifting local demand since any possible reduction in Hydro billing could be offset by the increased capital or administrative costs of demand management techniques.

The energy crisis is changing all this. First, both fossil-fuelled and nuclear generating stations are becoming increasingly capital intensive. Yet in 1976, the provincial government imposed a capital constraint on Hydro. Hydro must now be concerned about both the level and the rate of growth of consumption. Demand management policies for the bulk supply as well as the local distribution levels are high on its agenda. Second, in view of the increased costs of electricity production, the Ontario Energy Board (the provincial agency which looks into matters related to Hydro's rates) is reviewing Hydro's methods of establishing costs and setting tariffs. A major issue will be the extent to which pricing policies can reduce peak and total demand. Quite possibly too, the Porter Commission will make recommendations regarding pricing and electrical load controls as ways of cutting back on projected generating capacity.

Hydro's Load Management department, established in October 1976, is now conducting in-house studies and working with such groups as the Association of Municipal Electrical Utilities (A.M.E.U.) and the Ontario Municipal Electric Association (O.M.E.A.) to determine which electrical loads are most suitable for controls, which types of controls are feasible, and what complementary pricing strategies are required.[1] For 1978 Hydro is planning two field trials of load management systems and has invited interested municipalities to respond.

More of such collaborative effort is required. The recent bulk electrical metering report, prepared by a tri-partite committee of Hydro, A.M.E.U. and O.M.E.A., is an example of the useful work that can be produced.[2] Further, there is a valuable role for utilities to play not just responding to

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1 In the residential sector, space and water heating controls offer the most potential, with the possible development of new storage equipment. There are also opportunities in the commercial and industrial sectors. Two useful reviews of available pricing and load control techniques are the Leighton and Kidd study, Report on Electrical Load Management Possibilities, prepared for the Porter Commission, June 1976, and a study by Robert Uhler, Rate Design and Load Control, a report to the National Association of Regulatory Utilities Commissioners, November 1977.

2 "A Study of the Relative Merits of Bulk and Individual Electrical Metering for Apartment Buildings in Ontario", prepared by Hydro, A.M.E.U. and O.M.E.A. for the Ministry of Energy, December 1977.

Hydro's initiatives but also in making imaginative proposals of their own. They are perhaps the best judges of local consumer acceptance of innovations and the incentives that might be needed. They are also outside the cast of central system thinking and therefore might be better able to provide the needed push that will precipitate the transition from an electrical power system based on cheap fuels and high levels of demand to one based on conserver principles.

The third role for a municipal utility —generation of electricity from local sources (cogeneration, hydraulic power)— was discussed earlier in this *Topic*. Local generation permits use of waste materials and available renewable energy sources, as well as a reduction in demands on the central power system. Both the local community and Hydro benefit. Again, the issues are financial, administrative and jurisdictional.

CONCLUSIONS

In this *Topic* we have demonstrated that Ontario municipalities can play an important and leading role in promoting the more efficient and less extravagant use of energy and the development of renewable energy supplies. In doing so, they would be contributing to reduced overall energy demand and to an acceptable transition from a fossil-fuel energy society to a renewable one.

The opportunities we have outlined are consistent with the Science Council's conserver society principles that are being discussed widely in the media and other public forums. The conserver society is one where more is done with less, the long-term view prevails over short-term political and economic considerations, and government policy is directed toward ensuring system variety and adaptability, decentralization of responsibility, and optimal performance from local resources. As David Brooks of Energy Probe has stated:

> "Canada as a Conserver Society is not a gloomy vision asking everyone to grin and bear a voluntary return to the grubbing Thirties. Instead it outlines a way of doing things that seems highly sensible, creature comfortable, and intriguingly creative."[1]

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1 See "The Conserver society is a blueprint against waste", Toronto Star, January 24, 1978.

There are not a great number of constraints on action; most are attitudinal. The removal of other important obstructions depends largely on decisions by senior levels of government: for instance, financial and legislative changes. Even on these, however, we have argued that municipalities should not wait but should instead take the initiative. There are several benefits worth obtaining: short- and long-term savings in energy bills for either the municipality itself or the people it represents; reinforcement of the community's social, economic and environmental objectives; and an increased measure of self-reliance and security in an energy future that is uncertain.

So where to begin? We suggest the following actions:

* *Affirm in a clear policy statement the council's commitment to develop a conservation and renewable energy programme; set realistic targets.*

* *Direct all department heads to participate in an internal energy management programme.*

  There are a number of organizational options for ensuring coordination of efforts. The programme would involve conducting a systematic survey of energy usage (an energy audit), identifying and acting on areas for savings, monitoring energy usage, and applying life-cycle costing methods when repairing, upgrading or acquiring new equipment or systems.

* *Direct planning, building inspection, development, works, and other appropriate staff to design a comprehensive energy management programme for the municipality as a whole.*

  To establish priorities, a community energy audit should be compiled. In general, official plans and secondary plans should promote higher densities, reduced use of the private auto, and mixed land-use arrangements. This policy intent should be carried through in day-to-day decisions: energy-related zoning by-laws, subdivision agreements, site planning requirements, building practices, and servicing and transportation policies.

* *Encourage developers to bring forward innovative and affordable proposals for upgrading existing residential, commercial or industrial buildings or for constructing new energy-efficient ones.*

  This could include offering a density bonussing scheme or exploring with developers the feasibility of providing district heating or other integrated energy systems.

* *Sponsor or participate with private industry and other groups or agencies in demonstration and pilot projects which make optimal use of local energy resources.*

  Schemes for recycling and resource recovery, district heating and cogeneration, hydraulic power, and solar energy applications all have potential, depending on local conditions.

* *Pressure local utilities to mount aggressive consumer education programmes and experiment with demand management policies.*

* *Encourage local school boards to implement internal conservation programmes and teach the need for prudent use of energy in the classroom.*

* *Lobby individually and through established municipal organizations for needed financial, legislative and administrative changes at the senior levels of government.*

  Energy concerns should be incorporated in The Planning Act and the Ontario Building Code should be revised so that it covers all types of buildings and requires at least the new national conservation standards to be met. Government and private lending agencies should be pressed to provide tax incentives and front-end capital in the form of grants, low-interest mortgages, etc., to support innovative projects.

This *Topic* is intended to provide an introduction to energy planning at the local level and to promote an awareness of the nature and scope of the municipal role. There are many questions not covered. Some of these are questions of detail: what is the energy-intensiveness of different conservation options? how can municipalities best exchange information and experience? how are planners, building inspectors and other officials to be trained to carry out energy management policies?

Other questions not discussed involve considerations of equity —who gains and who loses when energy considerations are applied at the municipal level. For instance: what effects will higher densities in some areas have on land values? how will the entry costs of home ownership be affected? will energy savings achieved by landlords be passed on to tenants? will small builders be able to meet new energy regulations?

This *Topic* does point out the potentially far-reaching significance of municipal initiatives in energy planning. By deciding to act on their own rather than leaving energy policy solely to senior governments and large energy corporations, municipalities can influence the energy choice facing Ontario. Municipal action may even begin to pose a counter-thrust in the present centralized drive toward a high-technology fossil fuel and nuclear electric society.

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Charles K. Bens, Executive Director
Co-authors: Pamela Bryant, Anne Golden

APPENDIX

The following is a representative list of the main organizations and government agencies involved in energy conservation and the development of renewable energy supplies. A more comprehensive listing —covering research activities, programmes, and related publications— is contained in The Ontario Energy Catalogue, prepared by Wyley Powell and Walter Folby for the Ryerson Energy Centre, Summer 1977. For further information contact: Mrs. Mary Virtue, Librarian, Ryerson Energy Centre, 50 Gould Street, Toronto, Ontario M5B 1E8 Telephone: (416) 595-5400.

Federal Government

Department of Energy, Mines and Resources, Office of Energy Conservation, 580 Booth Street, 17th Floor, Ottawa, Ontario K1A 0E4 (613) 992-9379
Contact: Graham T. Armstrong, Research Director

Ministry of State for Urban Affairs, Energy and Urban Form Program, Ottawa, Ontario K1A 0P6 (613) 993-1732
Contact: Dr. W. Griggs, Program Coordinator

National Research Council, Division of Building Research, Montreal Road, Ottawa, Ontario K1A 0R6 (613) 993-9101
Contact: Dr. D. G. Stephenson

Ontario Government

Ministry of Energy, Energy Conservation Group, 56 Wellesley Street West, 12th Floor, Toronto, Ontario M7A 2B7 (416) 965-3246
Contact: Marcia Dorfman, Information Officer

Ministry of the Environment, Resource Recovery Branch, 4375 Chesswood Drive, Downsview, Ontario M3J 2C2 (416) 636-8015
Contact: G. Chisamore, Program Development Section

Ministry of Housing, Project Planning Branch, Residential Area Design and Energy Consumption Project, 60 Bloor Street West, 8th Floor, Toronto, Ontario (416) 965-1637
Contact: S. J. Clarke, Manager

Ministry of Transportation and Communications, Transportation Energy Management Programme, Urban and Regional Planning for the Efficient Use of Transportation Energy Project, 1201 Wilson Avenue, Downsview, Ontario M3M 1J8 (416) 248-3766
Contact: David Nitkin, Supervisor, Land Use Analysis Group

Other

Energy Probe, 43 Queen's Park Crescent East, Toronto, Ontario M5S 2C3 (416) 978-7014
Contact: Jan Marmorek, Information Officer

Sierra Club of Ontario, 47 Colborne Street, Suite 308, Toronto, Ontario (416) 366-3494
Contact: L.R.L. Symmes, Chairman

Royal Commission on Electric Power Planning, (Porter Commission), 14 Carlton Street, 17th Floor, Toronto, Ontario M5B 1H5 (416) 965-2111
Contact: Ann Dyer, Executive Assistant

Ontario Science Centre, Energy Exhibit Hall, 770 Don Mills Road, Don Mills, Ontario (416) 429-4100
Contact: Len Brown, Area Head

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Bank of Nova Scotia
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Thorne, Riddell & Co.
Toronto Real Estate Board
Weir and Foulds
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Reg. Mun. of Niagara
Edmonton City Parks and Recreation
Borough of North York
Oakville
Ottawa
Reg. Mun. of Ottawa/Carleton
Reg. Mun. of Peel
Richmond Hill
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BUREAU OF MUNICIPAL RESEARCH
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