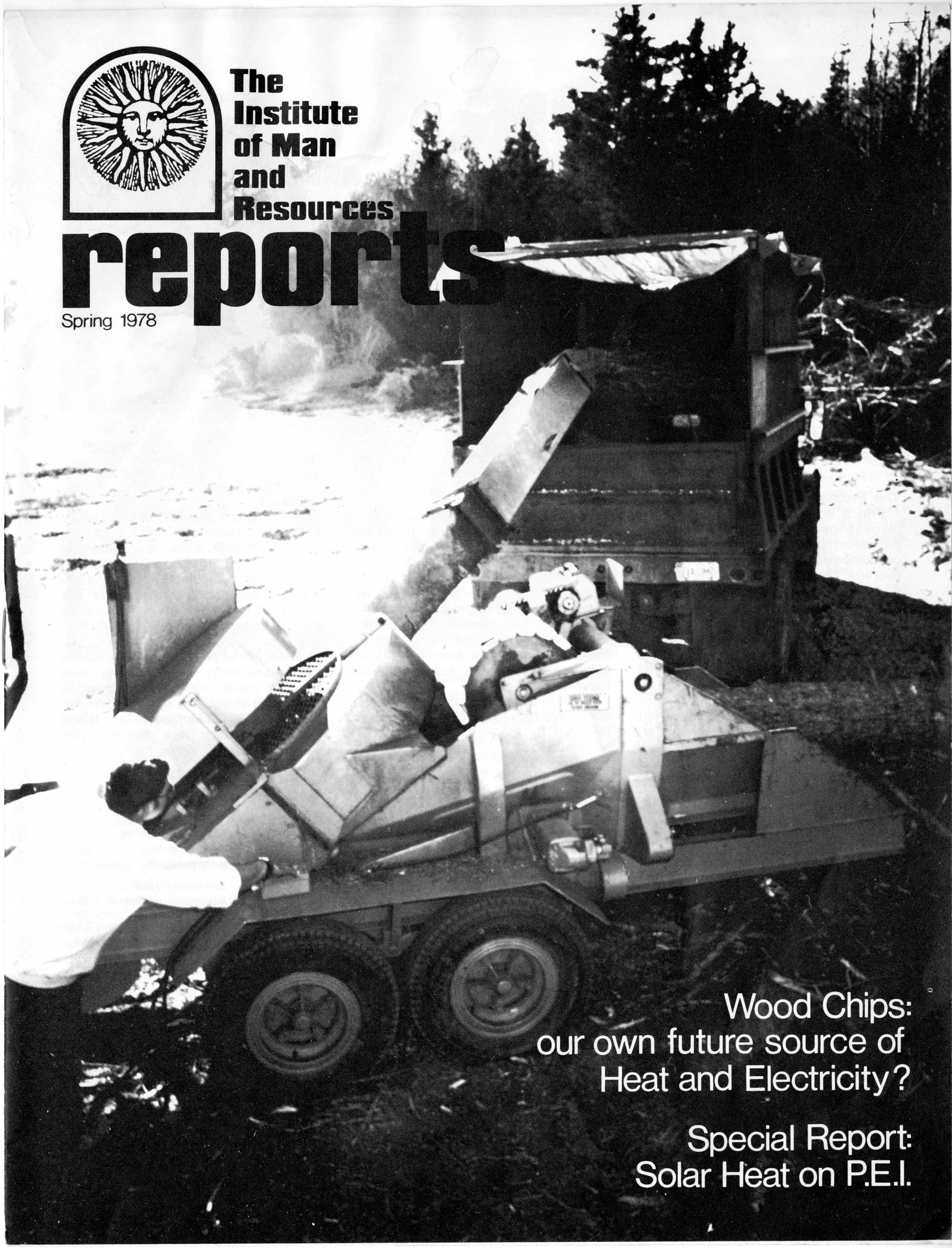
The Institute of Man and Resources

reports

Spring 1978



Wood Chips: our own future source of Heat and Electricity?

Special Report: Solar Heat on P.E.I.

Wood Chip Harvesting in P.E.I.

The Problem

Prince Edward Island is one of the largest per capita consumers of petroleum products in Canada, with a consumption rate 7% above the national average. This high consumption figure is due to the fact that P.E.I. is 100% dependent on oil for the production of electricity. However, even when the oil consumed in electrical generation is removed from the calculation, per capita consumption is still close to the national average of 26 barrels annually.

Of the total amount of energy consumed in the province, 46% is converted to low-grade heat. Of the remainder, 51% is converted into work such as transportation and the remaining 3% is used as high-grade heat in, for example, metallurgical processes.

If P.E.I. could find economically viable energy alternatives to replace all or a part of the oil consumed in low-grade heat, the Province would be able to husband petroleum for applications where alternatives are not readily available.

The Institute of Man and Resources, under the Canada-P.E.I. Agreement on Renewable Energy Development, has established as one of its research and development programs, a comprehensive investigation into the feasibility of using wood as an energy source in P.E.I.

This concept is currently being developed in other areas of North America and Europe. Sweden, for example, already obtains 7% of its total energy budget from residues of its forest products industry[1]. In Maine, new technologies are being designed to use the annual logging residues which represent the energy equivalent of about 7 million barrels of oil — the amount of fuel used yearly for residential heating in Maine[2].

Within the overall objective of its wood program, the Institute of Man and Resources will determine: the quality, availability and cost of the Province's wood resources; potential markets for wood fuel; appropriate harvesting techniques and equipment; suitable institutional, commercial, or industrial wood heating demonstrations; and the social, economic and environmental effects on P.E.I. of a full-scale wood harvesting program.

It was in this context that a whole-tree wood chip harvesting program was carried out by the Institute in October-November 1977.

The Resource

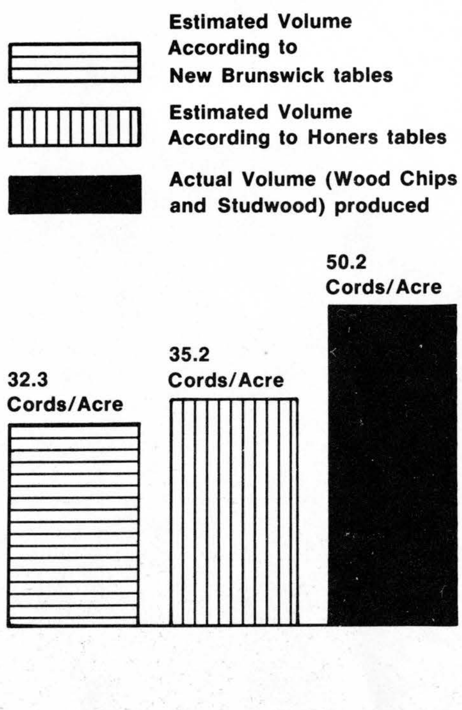
There are over 240,000 hectares of woodland in Prince Edward Island, comprising 43% of the total land area. Although surveys show that approximately half this woodland is covered with wood suitable for saw logs or processing, sawmill operators in the Province are finding it increasingly difficult to harvest merchantable timber economically[3].

Ownership of Island woodlots, apart from 25,000 hectares of Crown land, is in private hands and, unfortunately, most woodlots suffer from poor management. In 1975, less than 1/2% of all woodlot owners had prepared and were following a professionally developed woodlot management plan. It is estimated that over 100,000 cords of wood are lost annually through trees dying and rotting[4].

Based on the technology and forest use now practised in the Province, an average sustainable yield of 1.2 cords per hectare per year is being obtained. An annual allowable harvesting rate of 160,000 cords has been suggested for Prince Edward Island but the actual harvested volume, although it fluctuates from year to year, is always considerably less than this figure[5].

Both the sustainable yield and allowable harvesting rate figures are based on traditional forestry practices and estimating techniques. Through improved management (for example, developing and planting shorter-rotation tree plantations), much higher sustainable yields are believed possible and actual inventories of total fibre may be greater than estimated. In fact, Island forests can meet new demands, including that of providing fuel[6].

Estimated yields (Wood Chips and Studwood) Vs Actual yields



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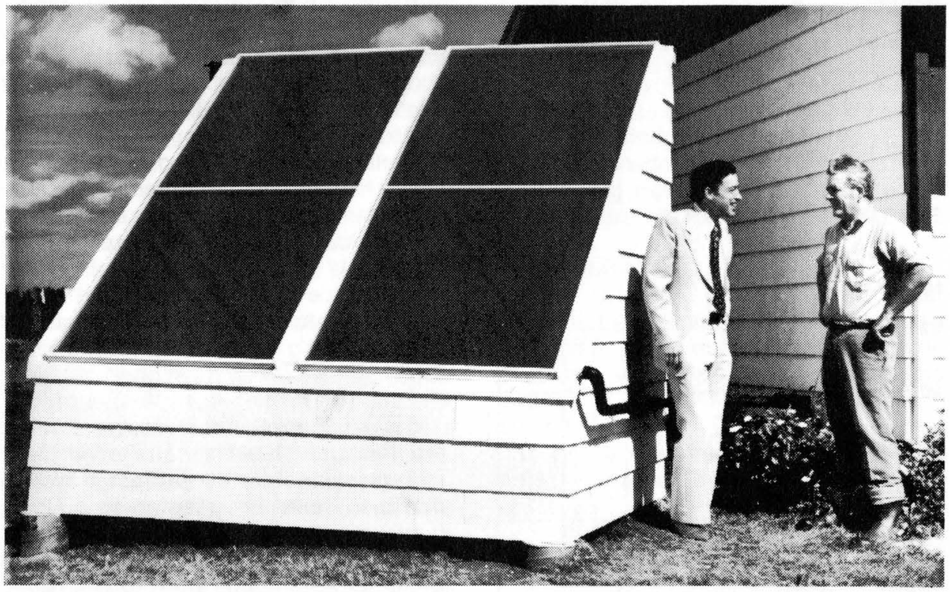


Solar

The Institute of Man and Resources has been given a broad mandate to explore, develop and demonstrate means by which Prince Edward Island can increase its self-reliance. Within this overall objective, an immediate priority has been set to develop indigenous, renewable energy sources.

There are two important reasons for establishing this priority. The Island is, at present, dependent on petroleum and petroleum-based products for 98% of its energy needs. This dependence has already had an inhibiting effect on the development of the Island economy. As the price of oil continues to rise, the implications for the Island will be even more severe.

Secondly, Andrew R. Flower, policy analyst with the British Petroleum Company, has predicted (**Scientific American**, March 1978) that sometime in the next five to 20 years, it will not be possible to produce oil at a rate which will satisfy all demands. If the search for alternatives is left until this crisis point, it will be too late to develop the structures and attitudes needed to put renewable energy systems in place except by 'crash' programs which could be seriously disruptive to Island lifestyles.

The Solar Prospect

Of all the renewable energy options available in Prince Edward Island, solar energy is one of the most attractive. It is abundant, free and environmentally sound. Equally important, there is already sufficient solar technology available in Canada and throughout the world to support initial design and construction work. Finally, although the solar energy available in P.E.I. is intermittent and diffuse, it can be collected at temperatures suitable for space and domestic hot water heating at relatively high efficiencies and low cost.

Solar energy cannot immediately take over supplying a major portion of the Province's energy needs, but the solar prospect is promising enough to begin the design, demonstration, development and education programs necessary to introduce solar technology to P.E.I.

The Solar Program

There are three major components being carried out as part of the Institute's solar program funded by the Canada-P.E.I. Agreement on Renewable Energy Development:

1) development of a weather data base suitable for use in designing solar systems;

2) monitored demonstration of current technology and;

3) review of currently available solar equipment to identify opportunities for design improvement and local manufacturing potential.

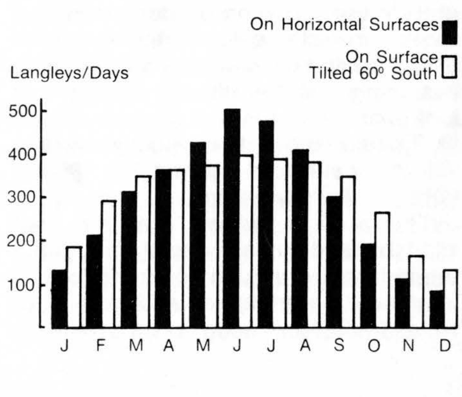
Weather Data Base

The objective of this sub-program is to prepare solar radiation data and other climatological data in a form suitable for design purposes.

Weather data are useful in two forms, depending on the degree of detail in the analytical techniques to be used. The f-chart method, developed at the University of Wisconsin by S.A. Klein and others, uses monthly average values of climate variables to predict long-term performance of several basic solar system types. For a more detailed examination of system performance or for the study of more complicated systems, hour by hour simulations are used requiring hourly weather data for a 'typical' year or several years.

At least ten years of weather data are necessary to provide reliable predictions of long term system performance. However, solar radiation, the most crucial weather variable, has only been recorded in Charlottetown since May 1971. In June 1977, instrumentation was installed in Charlottetown to record the diffuse component of the solar flux but in order to predict accurately the amount of radiation on an inclined surface, both the total radiation on a horizontal surface and the diffuse component are required. Although simple techniques for estimating the diffuse component are available, these are not suitable for use in Canadian latitudes.

Monthly Average Solar Radiation Charlottetown



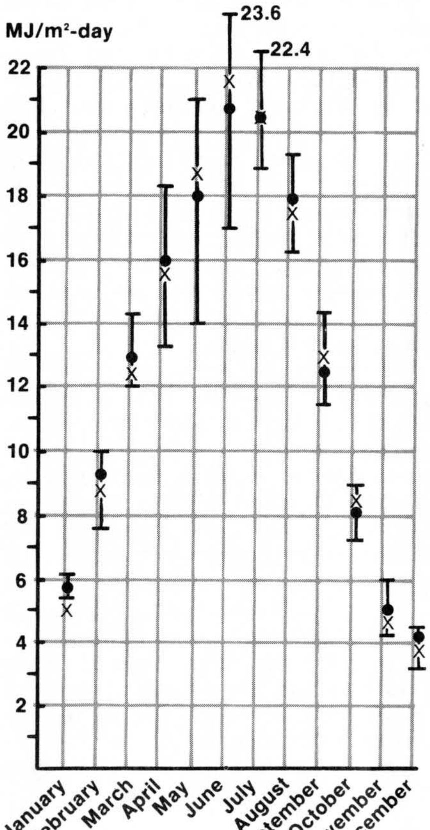
Hooper and Angus of Toronto, in co-operation with Professor John Hay of the University of British Columbia, designed techniques to estimate long term total and diffuse radiation in Charlottetown from other weather data. Figure 1 shows the monthly average values of total radiation on horizontal surfaces predicted by Hay, along with recorded data from 1971 to the present. It can be seen from the figure that the predictions are close to the actual monthly averages, although from year to year there is considerable variation in insolation.

Figure 1

Monthly Mean Radiation on Horizontal Surface - Charlottetown

Mean: Range of recorded monthly means 1971-1977

X **Hooper/Hay long term prediction**



Using the predicted values for total and diffuse radiation on horizontal surfaces, predictions for radiation on inclined south facing surfaces were made assuming that the diffuse radiation was isotropic.

Figure 2 shows the monthly average values for surfaces inclined 30°, 60° and 90° from the horizontal.

These data, which are the best available and currently used throughout the industry, are quite adequate for use in standard correlations such as f-chart to estimate the solar contribution to space or hot water heating on a monthly basis.

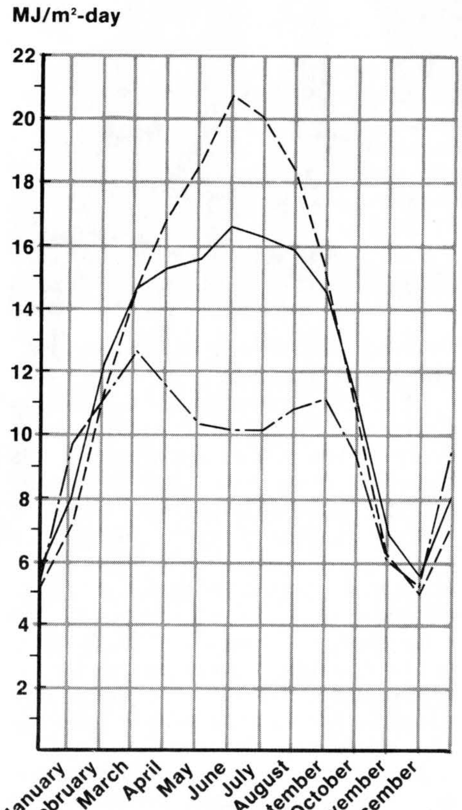
The f-chart technique has been adopted for routine design calculations on air and water space heating and domestic hot water systems. Quick design comparisons can be done using small desk-top calculators and printers.

In order to use the f-chart design method, data for the monthly average temperature and heating load are also required. Table 1 shows monthly average temperatures and Celsius degree days for Charlottetown. Care should be exercised in using degree day

Figure 2

Estimated Mean Radiation on South Facing Inclined Surface - Charlottetown

- - - - - - **30°**
———— **60°**
—·—·— **90° (Vertical)**



data to predict heating loads as solar gain through windows may make significant contributions which are difficult to account for.

An analysis of radiation data for the period 1971-1976 indicates that 1974 was a representative year and an hourly weather data tape has been prepared for use in detailed simulations.

Demonstration and Monitoring of Solar Equipment

Because of the advanced state of solar technology relative to other renewable energy options, the Institute decided to determine the applicability of solar heating to P.E.I. through a series of carefully monitored demonstrations.

In addition to demonstrating the technical feasibility of solar energy in P.E.I., the demonstration and monitoring program will provide data for design purposes and for performance comparisons among various commercial and custom designed solar systems.

By using local contractors to install the demonstration systems, the Institute is encouraging the development of the trade, contracting, engineering and architectural skills to support the further private development of a solar industry in the province.

Finally, demonstration projects allow the Institute to assess the overall economics of solar space and water heating systems in P.E.I.

1. Multi-family Dwelling

Preliminary studies suggest that solar space heating for a multi-family dwelling will be among the first applications to be economically attractive. Accordingly, the Institute is funding the installation of a solar space and domestic hot water heating system in a 16 unit apartment building being constructed in Charlottetown by an Island developer, J. Peter Steele.

Following preliminary design studies, the Institute chose an air-based, rock storage system for the project, a system that also could be adapted to a single family dwelling. A primary consideration in selecting this type of system was its demonstration value both to the Island and to the country. Des Barres House, as the project is known, will be the first use in Canada of an air system in a multi-family dwelling.

The Des Barres House design team includes Nick Nicholson and Marcel Dufresne, of Ayers Cliff, P.Q.; Anthony Caffell of the Institute; and John MacLennan, an architect with Allison and Sperry, Ltd.

The system will consist of an air collector using single glazing; a selective copper absorber plate and backpass heat recovery; a vertical, rock-based storage system; and a relatively simple two-speed air handler.

The project will involve local construction of the collectors, a technique successfully applied by Nicholson in building 11 moderately priced single family dwellings in the Quebec Eastern Townships region.

Detailed analyses of the systems on f-chart were used to arrive at design parameters which would supply at least 50% of the building's heat load while meeting the architectural limitations of a 28m² (300 ft²) roof area for each section. Storage volume has been established at 5.7m³ (200 ft³) per section.

The building design calls for, in effect, three separate sections or modules, each with an independent, slightly different solar heating system. Although

Table 1	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Degree days °C (below 18°C)	796	735	658	482	296	117	30	38	139	309	458	680
Mean temperature, °C	−7	−9	−3	2	8	14	18	18	14	8	3	−4

this will add to the initial design cost, the monitoring data will provide comparisons which should add substantially to the fund of performance information. The building will include an oil-fired backup heating system with separate thermostats in each unit.

In addition to the space heating systems, plans call for a domestic hot water system to supply all the apartment units and the common laundry. The solar contribution will come partially from each of the three solar collecting systems by means of individual air-to-water heat exchangers. Hot water storage tanks will be located in the laundry room.

Construction on Des Barres House is scheduled to begin June 1978 with a projected completion date of December 1978.

2. Solar Assisted Domestic Hot Water Heaters

Solar assisted domestic hot water systems (DHW) were selected as the second aspect of the Institute's demonstration and monitoring program. These systems have a short-term potential for being economically competitive with oil and electricity; they have an initial lower capital cost; they are relatively easy to add to existing housing; and they are ideal owner-built or do-it-yourself projects.

During phase one of the DHW project six systems were installed without charge in single family homes selected by a lottery. Table 2 outlines the design and location of phase one systems. Based on readings taken by the homeowner with borrowed monitoring equipment, it was estimated that during a sunny week in February the system installed at Mermaid, the first installation, supplied about 40% of the hot water load when the tank operated at 65°C and over 70% with the tank at 50°C. It was also estimated that at the current setting of 55°C the system would have supplied 50 to 70% of the demand. The seven day period included five sunny, one overcast and one rainy day. Ambient atmospheric temperatures were −9°C to +6°C. Average daily hot water usage was about 140 litres.

In phase two of the project, due to start in June, the remaining nine systems will be installed. Wherever possible, the Institute is attempting to select Canadian manufactured equipment.

Roland MacKinnon, field technician for the project, has identified several 'trouble spots' which would need to be resolved before a full-scale DHW program could be implemented in the province. For example, several suppliers were not successful in meeting promised delivery dates and some difficulty was experienced in clearing U.S.-built systems through customs. In some parts of the Island, contractors showed a lack of interest in installing DHW.

On the other hand, contractors who did take part in phase one proved both that a general trade background is sufficient training for system installation, and that good quality trade skills exist locally. Initial installation costs were high but there is good potential for reducing these costs as the trades involved gain a better knowledge of the systems.

The drain-down systems installed are performing well enough to indicate that this design will be viable in Maritime latitudes.

Equipment

The primary goals of the solar equipment program are to select and test solar hardware for demonstration projects; to assess the technical and economic potential for manufacturing solar hardware in the province; and to encourage construction of owner-built solar-assisted domestic hot water systems.

A continuing review of commercially-available solar equipment shows that while costs are remaining relatively high, performance ranges from good down to poor. If solar energy is to provide part of a near-term solution to energy shortages, an initial, important step is to design equipment that is lower in cost than that which is presently available, equal or superior in performance; and feasible for local manufacture. The approach chosen by the Institute of Man and Resources is to stress the development of high-efficiency air-cooled collectors, possibly coupled with in-ground, wet-earth storage (mud storage).

Because of their basic design requirements, liquid cooled (water or anti-freeze) collectors are built from materials in the \$70-\$80/metre² (6-7 ft.²) range not including assembly labour costs.

By using air as the fluid in the solar loop, savings of \$30-\$40/per metre² on the absorber material alone can be achieved plus, because of a lighter weight, subsequent savings on the frame.

Air collectors are often modelled on water collector design, using flat plate absorbers which are known to give poor heat transfer to an air stream; the result is reduced collector performance. The use of a porous absorber through which air is blown gives much better heat transfer and a much lower weight.

The Institute is also conducting a study of light-weight, plastic glazing films. Tempered low-iron glass is long-lasting, aesthetically pleasing and optically efficient. However, any glass is heavy and expensive both to buy and to mount in a way that avoids leaking or breakage.

Glass also requires that the collector frame be rigid (and thus heavy) enough to be handled without twisting and breaking the glazing. On the other hand, plastic films are available which are strong, sunlight resistant and temperature stable.

The usual image of loose polyethylene sheets flapping in the breeze cannot be applied to these high-strength plastics. They are factory-installed on frames, drum-tight and, with a matte finish, pleasing to look at. Lifetimes in the Maritime climate are expected to be about ten years.

However, these inexpensive materials do require innovative approaches. The Institute is now working on methods of installing plastic glazing films so that they remain tight without being difficult or expensive to mount.

A prototype air collector using plastic glazing will be used in a solar assisted domestic hot water system incorporating a finned-tube heat exchanger to transfer heat from the air loop to the solar storage tank. The combination of a standard heat exchanger and glass-lined water tank is cheaper and more effective than a special solar water tank with built in heat exchanger. The air collectors are designed to operate with low air velocity and flow rate so that small blowers and duct work can be used at approximately the same cost as pumps and plumbing.

Improving the cost effectiveness of one part of a solar system will only have a major impact if all the other parts are developed in proportion. Producing an inexpensive collector will still leave an expensive system if the storage component costs a lot.

A useful concept to keep in mind when considering heat storage is that of "inventory turnover", or the frequency at which the storage system is put through a full temperature cycle. For example, if the stored energy were given a fixed value, say \$5 to \$10/gigajoule (one million BTU), then a storage unit which cycles this amount of energy 50 times per year can cost 50 times as much, installed, as one which cycles only once per year (annual storage). Any increase in the storage period without a proportionate decrease in cost will result in a unit-energy cost penalty compared with shorter term storage.

With this concept in mind, the Institute has begun a study of wet-earth in-ground storage for use with either residential or greenhouse space heating. The project will involve corrosion resistant duct work, probably plastic, buried in an insulated, moisture-tight zone in the ground, perhaps under a house or greenhouse or even in the backyard.

In such a system, air from the collectors or greenhouse is blown through the buried ductwork and, because of the reasonably good conductivity of wet earth, heat is transferred to the surrounding soil. On reversing the air flow, the stored heat can be extracted to heat a building.

The number, size and spacing of ducts is important to the system performance and experiments are getting underway to measure the basic heat transfer parameters required to do a detailed design. The wet-earth storage concept may be relatively inexpensive to implement, particularly for an area that has no gravel for more traditional air storage systems. Indeed, the systems may even be cheap enough for annual storage.

In response to interest shown by the public, the Institute plans to conduct a series of workshops geared to homeowners wishing to construct their own solar-assisted domestic hot water systems.

Solar Economics

Determining the cost effectiveness of solar systems depends on several variables including the cost of an alternative system (oil or electricity); the cost of the system installed (owner-built or custom designed); current interest rates; and projected return on alternative investments. For example, would the money not spent on a solar domestic hot water system be invested in blue-chip stock or would it be spent on a more expensive car or a trip to Florida?

Because the Institute's demonstration program is still at an early stage, it is difficult to give a definitive answer on solar economics. It is, however, possible to follow an intuitive, 'best guess' approach.

Institute staff feel that if, as is expected, work progresses on increasing collector efficiency while reducing costs, solar will be competitive with electric heat for water heating within the next year. Owner built systems are certain to be economic within this time frame; commercial systems will probably be economically competitive.

The Institute feels that solar will be competitive with electric space heating in new housing within about five years.

In dealing with these projections, it should be noted that both solar space and solar domestic hot water systems can supply only a portion of the total heat required; generally speaking back-up systems will be required.

On the other hand, solar systems are somewhat different from conventional heating systems in that capital is invested one-time only, 'up-front' instead of on a continuing basis.

Policy Development

The challenge of providing energy options for Prince Edward Island is not solely a technical one. The integration of solar technology into the provincial energy network depends on the successful adoption of appropriate policies by both the public and private sector.

The Federal and Provincial Governments, for example, have already removed sales tax from renewable energy, including solar, equipment.

Guaranteed access to the sun, real property tax exemptions for solar systems, and solar installation loan programs are just some measures governments may introduce to interest the public in investing in solar systems. For example, governments may have to find ways of overcoming the reluctance people show to laying out large amounts of capital in a system, even though this might result in lower operating costs.

The popularity of buying goods on time suggests that some type of loan program with repayments made from savings might be effective.

The Institute of Man and Resources has been involved in a survey of solar related legislation, either introduced in or proposed for North American jurisdictions, in order to determine a direction for policy development in Prince Edward Island.

The Future

Because of its nature as a fossil fuel, oil will one day, perhaps in the near future, run out. The Institute of Man and Resources, through its solar program, seeks to establish the groundwork now for a smooth transition to a renewable resource base, taking into account all impacts such a transition will have on Island society.

Developing the solar resource will not necessarily reduce energy costs; it will, however, provide Islanders with an option. In the past, governments and the private sector have supported development of fossil fuel based technologies. The time has now come to invest research dollars into renewable alternatives.

Table 2

Solar Assisted Domestic Hot Water Systems

	Prince County		Queen's County		King's County	
Location	(Baltic) Kensington	Alberton	Bethel	Mermaid	East Point	Valleyfield
Domestic Hot Water System	Gas	Electric	Electric	Electric	Electric	Tankless Coil
Number of Residents	4	5	4	3	10	4
Array Size	6.7 m²(72 ft.²)	8.6 m²(92.5 ft.²)	6.3 m²(68 ft.²)	5.1 m²(55 ft.²)	6.3 m²(68 ft.²)	4.3 m²(46.2 ft.²)
Collector Mount	Ground	Ground	Roof	Ground	Ground	Roof
House Style	Wood Frame Farm House	Wood Frame Farm House	A-Frame	Bungalow	Wood Frame Farm House	Modern Wood Frame
System Design	Anti-freeze	Anti-freeze	Anti-freeze	Drain-down	Drain-down	Anti-freeze
System Supplier	Solatherm, Weston, Ontario	Sunworks, New Haven, Connecticut	Temperature Specialities, Downsview, (Envirogetics Panels) Solar Research Brighton, MI (Heat exchanger)	Amherst Renewable Energy Ltd.,	Dixon Energy Systems, Conway, MA	Lennox Co. Ltd. Etobicoke, Ontario

The Proposal

If, as proposed by the Institute of Man and Resources, Prince Edward Island were to develop its forest resources as an energy source through the harvesting of wood chips as a fuel for space heating and electrical generation, there would be several immediate and important benefits to the Province:

1. Cost Benefits

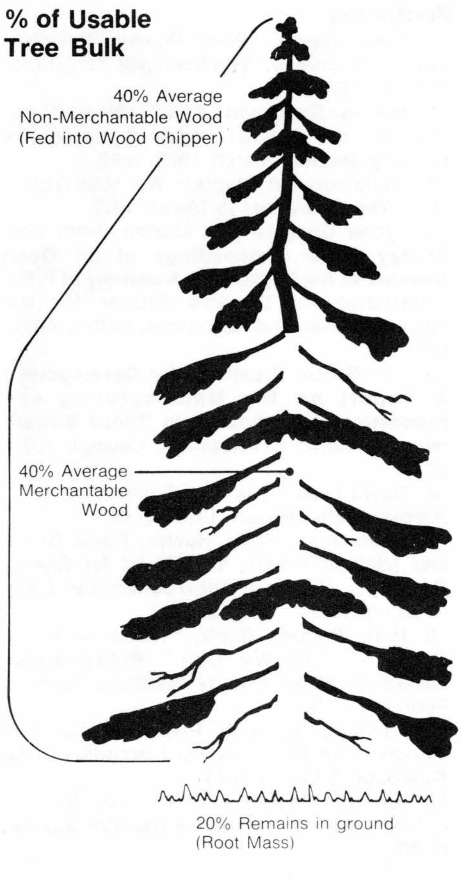
Wood chips are now being produced for fuel at a cost comparable to oil[7]. While the capital costs of wood burners are not yet competitive with oil, as the price of oil rises, the economics of wood as an energy source will grow more attractive. Moreover, unlike money spent on petroleum products, capital invested in the forest industry remains within the Province providing direct and indirect benefits to the economy.

2. Resource Development

Whole tree wood chip harvesting greatly increases forest yields of useful fibre. Forests which cannot now be harvested commercially for studwood and pulpwood can be successfully harvested for wood chips. Chip harvesting provides a use for hardwood which currently has little market potential in P.E.I. During traditional harvesting of high quality stands, as much as 50% of each tree—stumps, tops and branches—is wasted[8]. This resource, along with residues from milling operations, can be recovered and used as chips.

3. Forest Management

A greater use of existing forests, particularly through chip harvesting, will assist the recently-announced intention of the P.E.I. Government to upgrade the quality of Island forests. Wood chip harvesting solves the problem of waste disposal from harvesting operations and leaves a site cleared for reforestation. Any major forest restocking program in P.E.I. will require extensive clear-cutting. A system that ensures a market for harvested wood chips will provide woodlot owners with an incentive to take part in a cutting and reforestation program[9].



4. Employment

A full-scale forest industry in P.E.I. would provide employment in a variety of fields—employment which would complement the Island's traditional industries of agriculture and fishing.

The Experiment

Because P.E.I. has no history of whole-tree utilization, the Institute of Man and Resources carried out a nine-day test in a Cardigan area woodlot to demonstrate how chip harvesting could be integrated, at a minimal capital cost, into a traditional sawlog harvesting operation.

The objectives of the program were:
1) to determine the potential yield of chips from Island woodlots;
2) to determine the cost per tonne of wood chips;
3) to determine the quality (density, moisture content, size) of the chips harvested;
4) to demonstrate chip harvesting equipment and techniques to those involved or interested in becoming involved in the Province's forest industry.

The harvesting test took place between October 24 and November 5 on a 2.3 hectare site about 48 km from Charlottetown. The site consisted mainly of mixed hardwood and softwood, mainly balsam fir and spruce. Because the percentage of merchantable wood contained in the site was low, a logging contractor would not normally select the area for harvesting.

Major harvesting equipment used in the operation included: two Can Car C5 cable skidders; a Hahn Harvester; a Trelan D60 portable chipper; a D7 Caterpillar tractor; two dump trucks; and a rack-body truck for studwood transport. With the exception of the chipper, all the equipment used was typical of a

regular studwood harvesting operation.

Volumes of chips and studwood harvested were calculated and tests were conducted to determine the moisture content, density, and size of the chips produced during the harvest operation. The cost per tonne of green chips and the ratio of energy consumed in harvesting compared to the energy potential of the fuel produced were calculated.

The Results

1) The test indicated that wood chips can be harvested and transported to a central storage location or major user within a 48 km radius at a price of about $16.50 per tonne. This price compares favourably to Bunker C oil at $12 per barrel.

Additional experience with harvesting techniques and equipment could reduce these costs as much as $2.20 to $4.40 per tonne. The cost could be even further reduced if chip harvesting were carried out as a separate operation and not in conjunction with log harvesting.

2) The energy efficiency of the harvesting and transportation—both to central storage and local users—is such that over 20 times more energy potential is contained in the chips produced than was consumed in the harvesting operation.

3) The total volume of wood produced from the harvesting was 124 cords/hectare, equal to 225 tonnes/hectare. The actual volume exceeded forestry estimates carried out prior to harvesting by 30%. The yield was more than three times the estimated merchantable yield. To some extent the higher yields are due to the inclusion of branches and tops — wood that is usually wasted in the

Cut Along Broken Line

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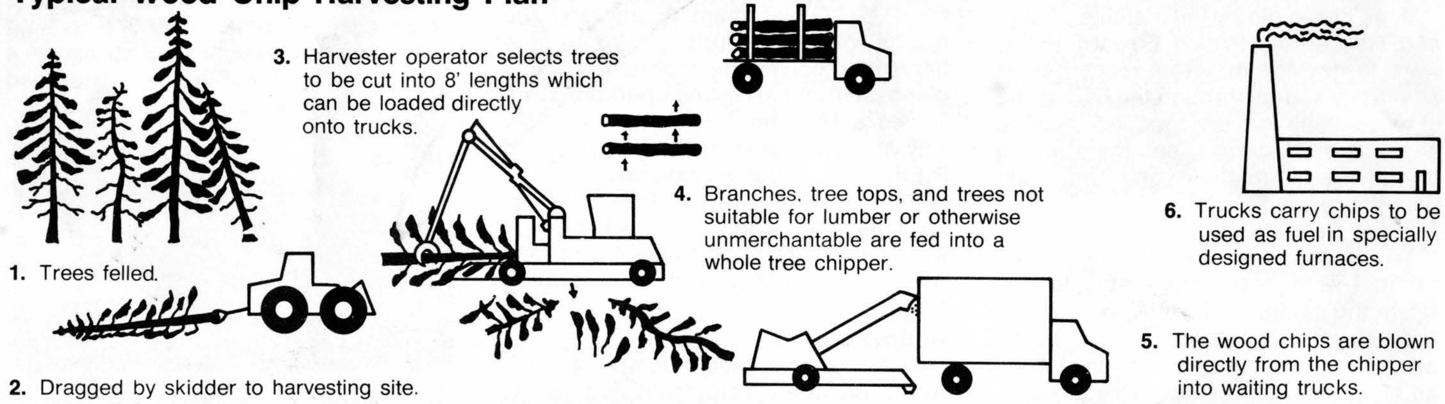
Typical Wood Chip Harvesting Plan



harvesting operation.

4) Despite an unusually heavy rainfall prior to the harvesting test, the wood chips contained less moisture than anticipated. The lower moisture content, in turn, meant a higher heat content from the chips harvested.

5) Because it was capable of producing chips at a competitive price, the equipment used in the test program successfully met the need for mechanization without altering present cutting operations in the Province.

6) The whole-tree harvesting test left a clean site, making reforestation in the area easier.

The Future

Any successful introduction of wood as a space heating or electrical generation fuel on Prince Edward Island requires the development of a comprehensive network to guarantee both a reliable supply of and a steady market for wood chips. A prerequisite for such a network is the co-ordination of initiatives from the Provincial and Federal Governments, the institutional sector and private industry.

An initial step in the wood program—proving the resource—has been taken. The Institute of Man and Resources is now gathering information on currently available wood burning systems both to select models for demonstration and to identify manufacturing and marketing possibilities in P.E.I.

In New England, wood chips are being used for space heating in a variety of applications including a wood-products factory, a vocational school, a senior citizens housing project and for municipal electrical generation[10].

Two possible demonstration sites for wood energy are a combined wood-fired generator and heating plant for the Elmsdale School in the western part of P.E.I. and a combination wood and refuse fired heating plant for the new Charlottetown hospital.

Further Information

A video tape of the harvesting test is available on loan for viewing by agriculture and forestry groups to stimulate interest in wood chip harvesting as an adjunct either to a conventional forestry operation or to farming.

A complete technical report of the chip harvesting test is available from the Information Officer, Institute of Man and Resources, P.O. Box 2008, Charlottetown, P.E.I.

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Footnotes

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