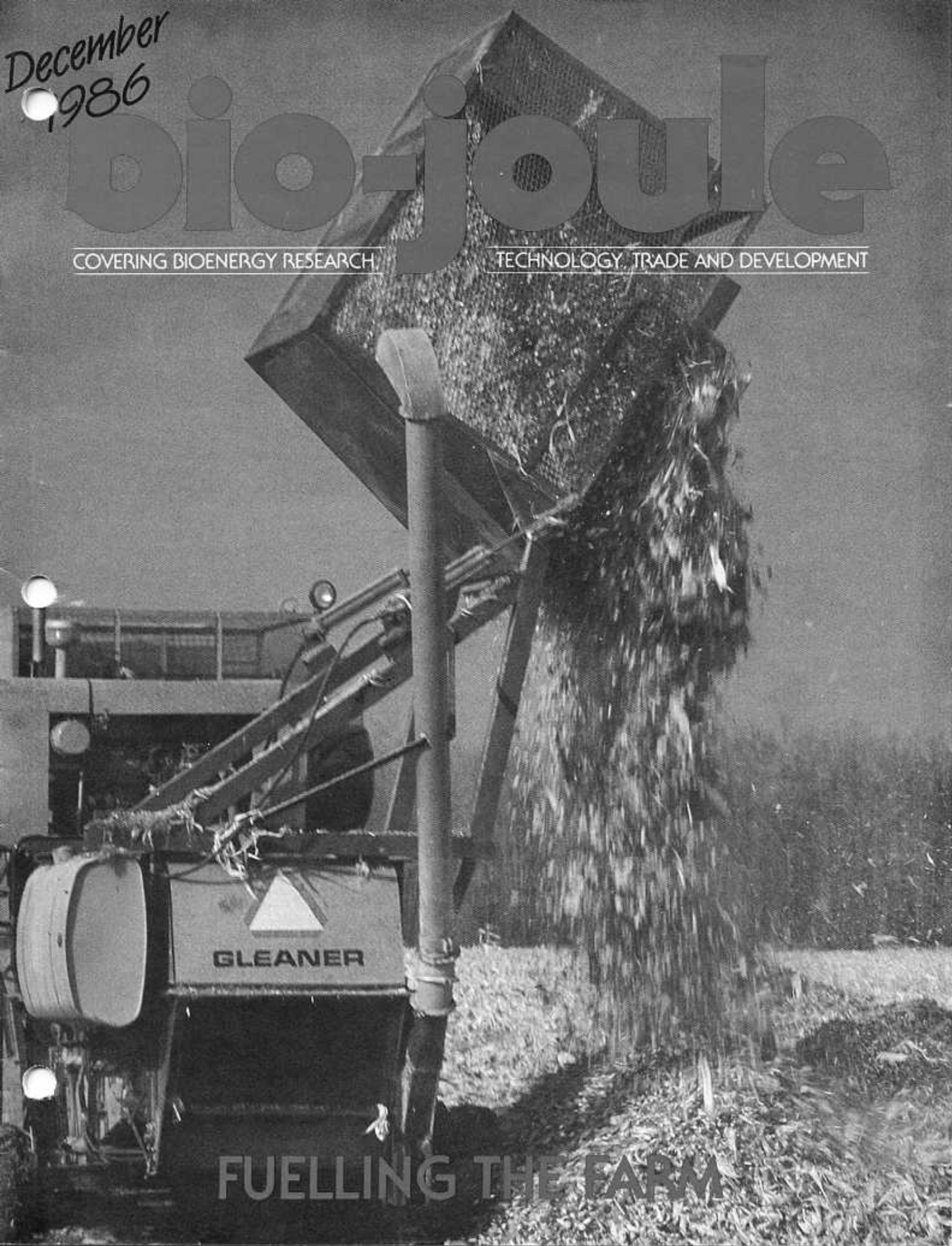


December
1986

Bio-joule

COVERING BIOENERGY RESEARCH,

TECHNOLOGY, TRADE AND DEVELOPMENT



FUELLING THE FARM

VOLUME 9 ISSUE 2

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Reviewing the Institute's activities

Dear BEI Membership,

All too often, members of organizations, such as ours, are not aware of the events that take place that make membership support worthwhile. This may be due to distance from the action, or lack of communication. To off-set this, and to let you know that your support has resulted in worthwhile and commendable effort — well, you be the judge.

During 1986, the staff of the Biomass Energy Institute have sponsored:

Conferences & Seminars

- Modern Urban Heating Systems: Energy from Waste Seminar. In conjunction with the Swedish Trade Council.
- Renewable Energy Conference '86.
- U of W Nuclear Waste Conference. Presentation and workshop on renewable energy technologies in Canada and their contribution in the energy mosaic.
- ASEAN-Canada Energy Seminar. Presentation of Canadian experience in alternative energy to 28 energy executives from ASEAN countries. There were two groups of eminent PhD's from the Pacific Rim countries, all in the energy field.
- Water and Waste Water Seminar. Presentation of paper on the waste management hierarchy and the function of the Manitoba Waste Exchange.

Contracts

- operation of the Manitoba Waste Exchange, including promotion of material recycling and industrial waste reuse as an alternative to disposal.
- management and update of E M & R's database of bioenergy contracts and the publishing of the contract summary report.

Information Dissemination

- public awareness of alternative energy systems, energy conservation, environmental concerns, recycling and waste management.
- publishing and dissemination of the Institute's publications **Bio-Joule** and **READS**.
- respond to information requests from industry and research centers world-wide.

Library

- maintenance and development of library resources. The Institute's resources are available to the public free of charge.

Computerization

- purchasing of computer hardware and software.
- development of informational data bases.

Industrial Liaison

- assisted Finnish and Danish firms in assessing Canadian market for their bioenergy systems
- assisting Kimberly Clark in establishing flaxshives as a viable energy resource.

We have a new Manager at the Biomass Energy Institute, in Dr. Beth Candlish. Beth started with us on November 15th, 1986. Peter Winter has resigned to become a Consultant in the technical publication area.

On behalf of the Board of the Institute, we wish you all a prosperous and energetic New Year!

E.A. (Ted) Speers, P. Eng, Chairman, Board of Directors, Biomass Energy Institute

Canadian Energy Situation Updated

Canada's reserves of light crude oil from conventional sources are declining and, if prices remain low, there could be a need to import substantial amounts of light oil during the 1990's, according to a National Energy Board staff study released Dec. 10, 1986.

If oil prices rise, the report projects that the country will have to rely much less heavily on imports. In that event, it is likely that it will be viable to produce oil in the frontier regions and upgrade heavy crude oil and bitumen to light oils.

In both price scenarios, Canada is projected to continue exporting heavy crude oil throughout the study period. The analysis in this report was conducted under two oil price scenarios, in the high oil price case world oil prices increase to \$ US 27 (1986) per barrel by 1993 and then remain unchanged in real terms to 2005. In the low oil price case world oil prices increase to \$ US 18 (1986) per barrel by 1992 and maintain that level thereafter. In both cases, we assume that natural gas prices are equivalent to the price of heavy fuel oil, retail prices differing only on account of transportation and distribution costs and taxes. We assume that electricity prices remain constant in real terms in both oil price cases. Economic growth is different in the two cases, reflecting the impact on economic growth of the different oil prices.

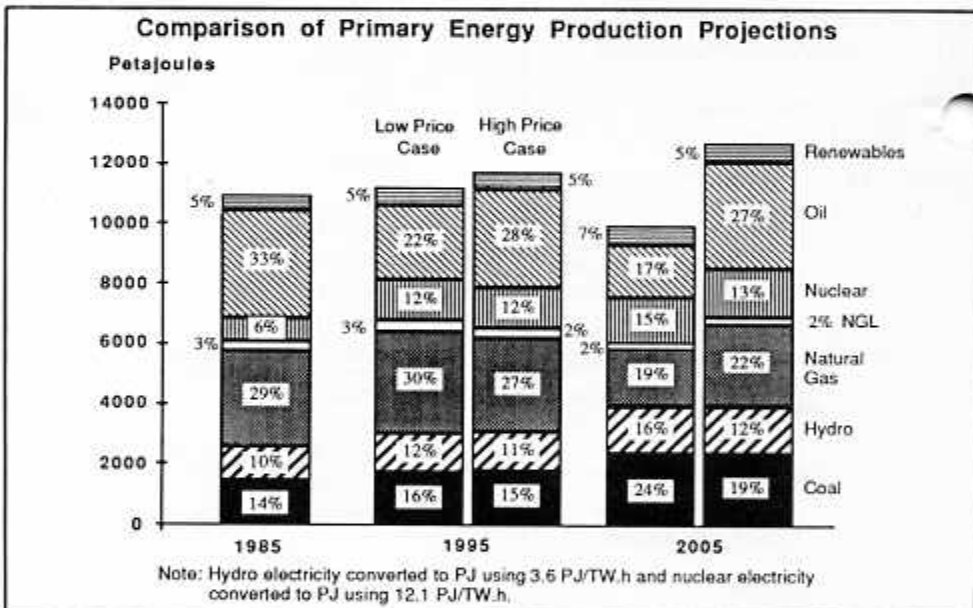
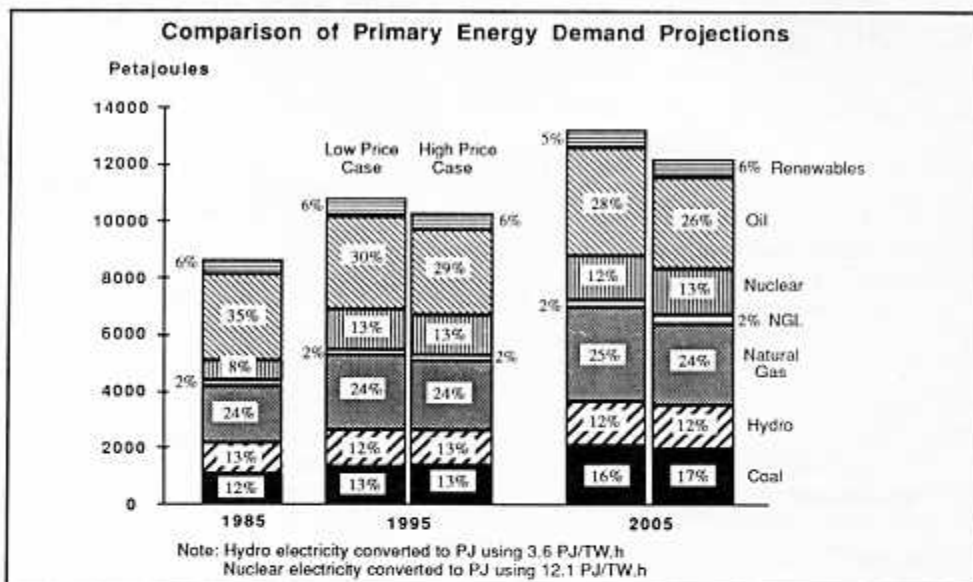
Demand

ected to grow at 1.5 percent per year in the high oil price case and 1.9 percent per year in the low, between 1985 and 2005.

Our assessment is that energy demand in Canada will continue to grow more slowly than will the economy; gains in energy conservation will occur even with oil prices below the levels of the early 1980s. The market share of oil will continue to decline to the point where oil will be used mainly for transportation, and the shares of natural gas and electricity will rise. The amount of oil used increases in both price cases over the outlook period.

Alternative Energy Sources

Alternative energy sources include hog fuel and pulping liquor, wood, solar, wind and municipal solid waste. They accounted for about eight percent of total Canadian end use energy demand



in 1984; however, in British Columbia where the forest industry makes extensive use of wood waste, they accounted for 23 percent, and in the Atlantic region, where wood is used to a large degree for residential heating, for 15 percent.

The degree of penetration of alternative energy sources depends on their costs, relative to the costs of other energy forms. As our present outlook is characterized by slower real price growth for conventional energy, we are now less optimistic about penetration of alternative energy than we were in the September 1984 Report.

In our low and high oil price cases we

expect renewable energy forms to account for 6 and 7 percent respectively of end use energy demand in 2005, about the same proportion as in 1984.

Technological developments which reduce the cost of these energy forms could result in their gaining a larger share of total energy demand than we have projected under our energy price assumptions.

Regional considerations — particularly the available alternative energy sources — may favour development and use of renewable and other non-conventional energy forms in some regions over others.

Catalyst patent will have environmental impact

The granting of Simon Fraser University's first two patents is cause for celebration in more ways than one.

For the researchers, it marks the successful completion of one phase of their work. For the university, to whom the researchers recently assigned shares in the patents, it is a gift whose worth could range from many thousands to many millions of dollars. But the major beneficiary promises to be the environment.

Dr. Roy Morrison and colleagues Dr. Bijan Mirejadi, Dr. Robert Frindt, Per Joensen and Mike Gee, have developed a better molybdenum sulfide catalyst. This catalyst is used for removing sulphur from oil and coals.

"Sulphur in automobile exhaust is one of the major causes of acid rain," says

Morrison. "Removing sulphur before processing crude oil into gasoline or fuel oil takes away a major source of contamination and reduces the amount of sulphur pumped into the atmosphere. This can improve the environment for everyone."

Present day processes for cleansing petroleum crude utilize molybdenum sulphide, the Simon Fraser catalyst, but only a small portion of the catalyst is active in the compound.

"The catalyst is in crystallites," says Morrison. "That means only a small portion is available for interaction."

The Simon Fraser process involves separating molybdenum sulphide into single molecular layers and wrapping these layers around the particles of

alumina. This means all of the catalyst is used and the process is far more active and effective. Tests of its activity, using methane formation from carbon monoxide and hydrogen as a test reaction, show a factor of 10 improvement over the presently used preparation technique.

The first of the SFU patents involves the process used to separate molybdenum sulphide into single layers while the second involves preparation of the catalyst itself.

Morrison says other applications of the process could provide such things as more efficient lubricants. "Because we can open up the molecular web, we can insert other substances to change properties."

California wind farm buys Canadian turbines

Harnessing the wind is an old idea that Ontario-based ADECON Energy Systems has used to develop its new 19-metre, vertical axis wind turbine.

The competitively-priced wind turbine took the new company three years to design, test and develop. Having signed a letter of intent for the sale of up to 50 of its turbines to a California wind farm developer, the company's future looks very promising. Collectively, the 50 turbines will be capable of generating some 7,500 kilowatts of electricity.

A demonstration of the 75 KW-capacity wind turbine was opened recently by at the Kortright Centre for Conservation, north of Toronto.

Under the auspices of its Energy Technology Development Program, the Ontario Ministry of Energy provided \$70,000, representing 27 per cent of the funding required for the development of the project. The successful completion of this development work resulted in the enhancement of the wind turbine's cost-effectiveness, reliability, and proposed lifespan.

The installation at Kortright is ADECON's first full-scale turbine connected to a power grid through the participation of Vaughan Hydro.

The ADECON wind turbine is capable of developing up to 125 KW under favourable wind conditions. However, the Kortright installation has been

scaled down to generate up to 75 KW, which is enough electrical power to meet the energy demands of some 25 houses.

ADECON'S design is attracting a lot of interest at home and abroad. The com-

pany has had successful negotiations with Hydro Quebec for an installation at the Magdalen Islands, in Quebec. International orders could come from as far away as Hawaii and the Greek Islands.

Manitoba supports Waste Exchange operations

Manitoba Environment and Workplace Safety and Health Minister Gerard Lecuyer has announced the awarding of a \$20,000 operating grant to the Manitoba Waste Exchange for the 1986-87 fiscal year.

The Manitoba Waste Exchange is a non-profit service designed to assist industries recycle their waste and surplus materials as an alternative means of disposal. The service is operated under contract by the Biomass Energy Institute.

Companies interested in finding or disposing of potentially useful wastes, materials to neutralize their waste streams, or materials that can be used as a feedstock can contact the Exchange to register materials they have available or could use themselves. These materials

are given a unique code number, then published in an Alerting Bulletin that is distributed to over 1100 companies three times a year. Businesses involved in waste management, consulting, recycling, or waste transfer and disposal can promote their services in the Bulletin for a one year period for a fee of \$50.00

There are currently over 100 waste materials registered with the Exchange. Materials listed in the Bulletin include organic chemicals, solvents and oils, metals, plastics and glass, and wood and paper products. Recent enquiries have resulted in over 11,000 litres of liquid materials being exchanged. The Waste Exchange can also provide companies with information on waste management, recycling systems, and material reuse possibilities.

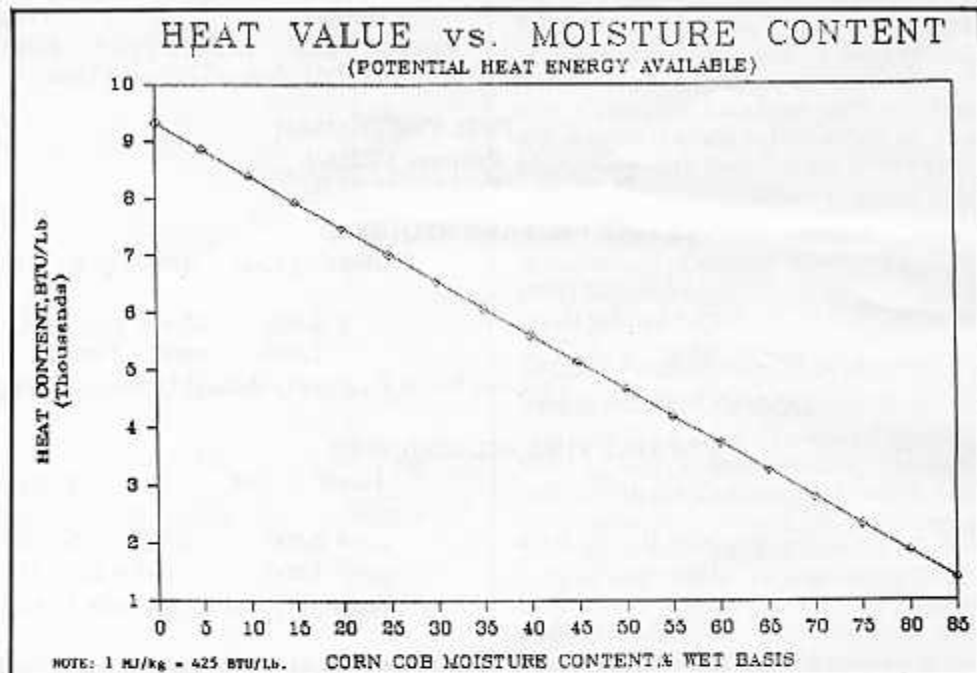
burns were calibrated to determine the flow rates at various head pressures. Since the circulation pumps for the shop and house could not be removed and calibrated, these two lines were shut off and only the two barns were used during the efficiency tests.

Test runs were carried out once the system had reached equilibrium and everything was working. Some of the tests had to be scrapped due to malfunction of some component, part way through the two hour test run. Three efficiency tests were carried out, (Table 1).

The average system efficiency from the three tests is $\frac{52 + 51 + 55}{3} = 52.6$ or approximately 53%. That is to say that this central cob-fired boiler system can recover 53% of the heat from the corn cobs.

Any problems?

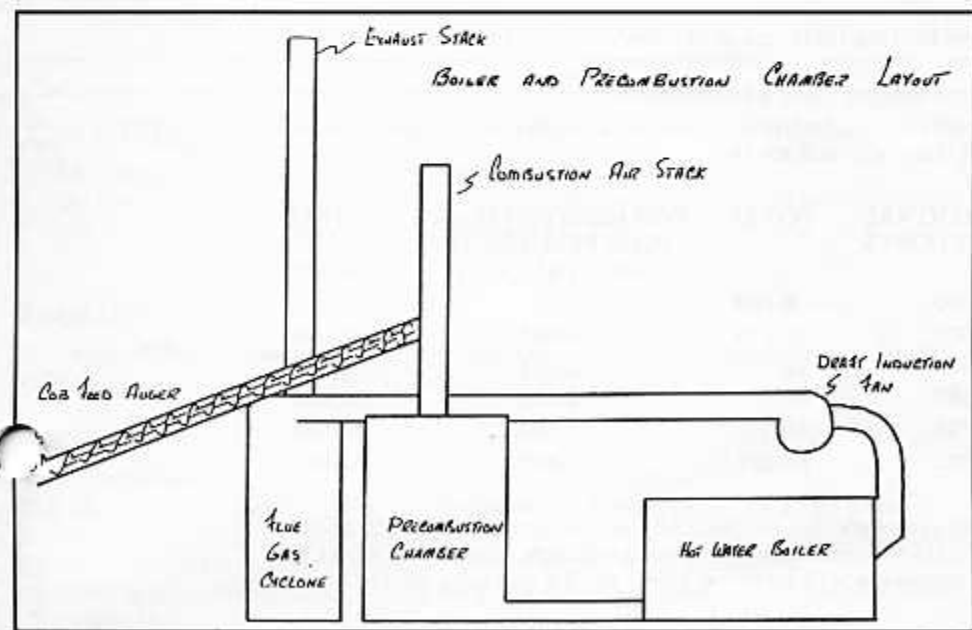
1. The system works well but still requires periodic checks throughout the day, possibly four to five times a day, to make sure everything is working. Small problems such as husks jamming micro switches would cause the system to stop functioning properly. Addition of more shielding to shelter the micro switches should eliminate this problem.
2. Proper cleanout of the boiler was required, on a weekly basis to remove ashes from the boiler firetubes.
3. Uncontrolled air leaks into the pre-combustion chamber caused elevated temperatures resulting in a clinker formation. Proper sealing of the ash cleanout door reduced this problem significantly.



Economics

Initial Cost of the Central Heating Plant (1984):

6.1 x 15.2m concrete stave silo, blower pipe, roof	\$10,700
2m elevated silo base, used flail unloader	11,000
perforated floor and aeration fan in silo	680
used 30HP hot water boiler	5,000
Boiler room modifications	1,100
Precombustion chamber, firebrick	430
Auger feed pipe, exhaust stacks	560
Underground hot water pipes and plumbing	7,200
Crane rental	250
Electrical work	2,800
Metal fabrication	3,100
Miscellaneous — valves, controls, pumps, etc.	1,500
	\$44,320



4. Because the precombustion chamber and transition tube were not externally insulated a large amount of heat was given off to the boiler room. The temperature inside this room could reach 50°C. Insulation of these two areas would contain the heat and make it usable for use in the house, shop or barns.
5. Obtaining cobs has not appeared to be a problem up until now. If the market for cobs for use for industrial purposes increases, this could affect the price and availability.
6. Due to numerous short stops and starts the motor which powers the silo unloader has burnt out twice. The drag chain conveyor will be reworked such that more cobs can be loaded in everytime the unloader starts.
7. When operating, the system produced little if any visible smoke from the exhaust stack.

Annual Heating costs ('83)	Old Broiler Barn	\$ 4,400	
	Shop	1,000	\$ 5,400 (Propane)
	New Broiler Barn	\$ 2,300	
	House	1,000	\$ 3,300 (Fuel Oil)
	TOTAL Annual Heating Cost	\$ 8,700	

FUEL COSTS (1983)

Propane \$0.215/L
Fuel Oil \$0.35 /L

ENERGY CONTENT

25.5 MJ/L
38.7 MJ/L

USEABLE PROPANE REQUIRED

	Heating Cost	Litres @ \$0.215	Litres Req'd For Useable Energy
Old Broiler Barn	\$ 4,400	20,465 x 95% eff.	= 19442
Shop	1,000	4,651 x 75% eff.	= 3488
		Propane Req'd To Supply Actual Useable Energy	= 22930L

USEABLE FUEL OIL REQUIRED

	Heating Cost	Litres @ \$0.35	Litres Req'd For Useable Energy
New Broiler Barn	\$ 2,300	6571 x 65% eff.	= 4271
House	1,000	2857 x 65% eff.	= 1857
		Fuel Oil Req'd To Supply Actual Useable Energy	= 6128L

∴ Total Useable Heat Req'd = 22,930L Propane + 6,128L Fuel Oil
= 22,930 x 25.5MJ + 6,128 x 38.7MJ
= 584,715 + 237,154
= 821,869 MJ

Useable Heat/Tonne of Cobs = 16MJ/kg (@ 27.5% M.C.) x 1000 x .53
= 8,480MJ

∴ Tonnes of cobs req'd to supply useable heat = 821869
8480
= 96.9
97 tonnes

Cobs cost \$15.00/tonne

∴ Cost of 97 tonnes = 97 x \$15.00
= \$1,455/year

ASSUMPTIONS:

- 1.) cost of conventional heating fuels and corn cobs will increase by approximately 10% annually.
- 2.) Initial cost of central heating plant \$44,320.00.
- 3.) Annual electrical costs to run electrical components of cob unloading and conveying system, pumps, fans, etc. is \$300.00.

YEAR	CONVENTIONAL HEATING COSTS	TOTAL	COB HEATING COSTS PLUS ELECTRICITY CAPITAL COST	TOTAL
1	8,700	8,700	1,755	46,075
2	9,570	18,270	1,931	48,006
3	10,527	28,797	2,124	50,130
4	11,580	40,377	2,336	52,466
5	12,738	53,115	2,570	55,036
6	14,012	67,127	2,827	57,863

Therefore within five to six years this central cob fired heating system will show a payback when compared to the conventional heating systems. The rate at which the price of various fuels increases will have an affect on the payback period of this system.

TABLE 1
SYSTEM EFFICIENCY TESTS

	TEST RUN #1	TEST RUN #2	TEST RUN #3
A. LENGTH OF TEST	2.25h	2.66h	2.0h
B. COB LOADING TIME FOR TEST	0.65h	0.85h	0.87h
C. COB LOADING RATE (CALIBRATED)	380kg/h	380kg/h	380kg/h
D. COBS BURNED PER HOUR TEST RUN	110kg/h	120kg/h	165kg/h
$\frac{(B \times C)}{A}$			
E. COB MOISTURE CONTENT	27.5%	27.5%	27.5%
F. HEAT VALUE OF COBS @ 27.5% M.C.	16MJ/kg	16MJ/kg	16MJ/kg
G. HEAT INPUT (D x F)	1760MJ/h	1920MJ/h	2640MJ/h
H. BOILER SUPPLY TEMP	80°C	83°C	89°C
I. OLD BARN RETURN TEMP	71°C	74°C	82°C
J. OLD BARN WATER FLOW RATE	4.4L/s	4.4L/s	4.4L/s
K. HEAT OUTPUT TO OLD BARN $(J \times 60 \times 60 \times 4.184 (H-I) \times 10^{-3})$	600MJ/h	600MJ/h	460MJ/h
L. NEW BARN RETURN TEMP	76°C	78°C	76°C
M. NEW BARN WATER FLOW RATE	5.1L/s	5.1L/s	5.1L/s
N. HEAT OUTPUT TO NEW BARN $(M \times 60 \times 60 \times 4.184 (H-L) \times 10^{-3})$	310MJ/h	380MJ/h	1000MJ/h
O. TOTAL HEAT OUTPUT (K = N)	910MJ/h	980MJ/h	1460MJ/h
P. SYSTEM EFFICIENCY $\frac{(O \times 100\%)}{G}$	52%	51%	55%

* specific heat of water = 4.184kJ/kg °C

CONCLUSIONS:

1. The average system conversion efficiency is approximately 53%.
2. This system has demonstrated that nearly automated heat production is possible.
3. With current fuel and cob prices this system has a payback period of 5 to 6 years.

SUMMARY:

As a result of this testing, a manufacturer has been approached and work is presently underway to develop a commercial unit which could be sold to farmers.

Acknowledgements:

The author would like to thank the cooperators; Arch and Ed McKinlay for their excellent work in putting this system together as well as data gathering. Their excellent cooperation made it possible for this report to be completed.

As well, Ontario Hydro for supplying the kilowatthour meter for measuring electrical consumption.

McKinlay boiler

The McKinlay corn-cob fueled boiler/hot water system was conceived and built by Mr. A. McKinlay of McKinlay Energy System Inc. a couple of years ago. Newmac Mfg. Inc., a well established manufacturer of commercial and domestic furnaces and boilers, are exclusive manufacturers of the McKinlay corn-cob-fueled boiler system.

P.O. Box 545, 980 Juliano Drive, Woodstock, Ontario N4S 7Y5 Tel: (519) 539-6147.

Drastic Reduction of Scientific Research in Canada

Concern has been expressed by private industry, universities, individual scientists and, most recently, the Professional Institute of the Public Service of Canada. The Institute is the bargaining agent representing NRC scientists, engineers and technical support groups. NRC projects are being terminated in mid-course, with the consequent losses in invested research funds, in equipment and in staff. Morale in the scientific community has been badly damaged by the lack of new initiatives to support R & D in Canada.

Since 1984, the budget of NRC has been reduced from \$520 million to \$400 million, and the number of employees from 2,600 to 3,100 NRC is now faced with more spending cuts and a further loss of 200 positions.

Is cutting spending and jobs at NRC part of the solution to Canada's economic problems? We think not. Instead, Canada must put more resources into a broad range of basic and applied research and development. Private industry, universities and government research agencies must all contribute in a balanced approach to technological growth.

The annual survey of the Financial Post (October 25, 1986) showed total expenditure on industrial R & D to rise about 3%, compared to 14% last year. Ten Crown Agencies proposed 2% more spending in 1986 than 1985.

Publications:

Measuring and Harnessing Alberta's Wind Resources

If you want copies, contact:

Alberta Energy and Natural Resources Information Centre, Main Floor, Bra-malea Building, 9920-108 Street, Edmonton, AB, T5K 2M4 Tel: (403) 427-3590.

Recycling program launched

by Jim Ferguson

A unique voluntary public participation recycling program for aluminum soft drink cans was officially launched in September by the Manitoba Soft Drink Association (MSDA). Manitoba Soft Drink Recycling, Inc. (MSDR), a non-profit organization, sponsored by MSDA's members and beverage industry suppliers was established to increase the recovery rate of used aluminum soft drink containers throughout the province.

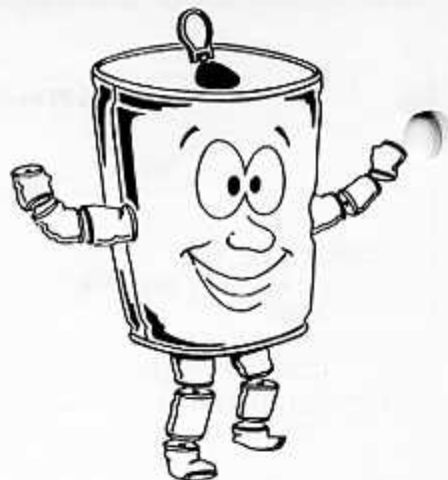
Using a truck and trailer operating as a mobile self-contained recycling and sorting depot, MSDR plans to route its first vehicle to designated locations on a regular bi-weekly basis in Winnipeg. Recyclers will be able to return used aluminum soft drink containers to the "recyclomobile" for an immediate cash payment. At present two major food-store chains, Superstore and Safeway, have endorsed the recycling program and are providing space in their parking lots for MSDR's recyclomobile to park at specific times.

Recent statistics indicate approximately 90 million cans of soft drinks quenched the thirst of Manitoban's during 1985, an average of about 90

cans per person. MSDR is aiming to recover 100 - 200 tons of used soft drink cans within its first 12-18 months of operation, representing a potential cash value up to \$150,000 for the public. The recycling public will be paid by the pound, based on the number of cans returned for recycling. MSDR comptroller Peggy Taney says this works out to be about 25 cents per pound or one cent per can buy back value.

As the operation progresses, the MSDR General Manager, Bill Bater, says it is conceivable to realize a continual increase in the recovery of used cans to a volume exceeding 1,000 tons per year. This would represent about \$750,000 paid to recyclers.

On a national scale, Manitoba is the only province that has opted for encouraging voluntary recycling of soft drink aluminum cans. Other provinces such as Alberta and Quebec have mandatory deposit legislation which requires consumers to return used beverage containers to recycling depots or to retailers for a refund. This causes increased overhead for the retailer. Both methods are costly to operate and in many cases mandatory deposit pro-



grams perform below the efficiency and recovery rates demonstrated by voluntary participation programs.

By recycling used aluminum beverage containers a 95 percent saving of the energy required to manufacture aluminum from ore is achieved. In addition, the aluminum cans are removed from the waste stream, reducing the amount of material going to landfill, as well as, providing cash to the consumer for recovered cans and providing an incentive to reduce litter.

For further details on MSDR, the recyclomobile's schedule and information on recycling projects and how to organize them, call MSDR's HOTLINE at: (204) 783-5349.

The Manitoba Waste Exchange Waste Works!

Trading, buying or transferring wastes between or within industries is a relatively new approach to solving the old problem of reducing industrial waste. As legislation governing waste disposal becomes more restrictive and the cost of energy and raw materials rise, many companies are looking at ways of recovering waste products.

Manitoba Waste Exchange

The Manitoba Waste Exchange is a non-profit service promoting cost effective waste recycling and reuse between industries as an alternative to disposal. The intent of the program is to help businesses take advantage of waste exchange opportunities in an economical, efficient and confidential manner. The Exchange serves industry in the prairie region and distributes information throughout Canada and the United States.

How Does The Exchange Work?

The Manitoba Waste Exchange operates by obtaining listings of available or desired waste materials that have been registered with the Exchange. The listings are classified and coded to ensure that the identity of the listing company remains confidential. Inquiries about listings are forwarded to the listing company and it is up to them to initiate any follow up. The Manitoba Waste Exchange does not actually take possession of any waste product. As such, it facilitates waste transfers, but does not actually conduct them.

What Are The Benefits?

The basic principles of waste recycling are similar for both large and small companies. Wastes may be recovered for use in the same processes that first generated them, enabling a substantial saving in the cost of purchasing new materials. Or they may provide valuable raw material for another company. By applying recycling concepts, a company can: -conserve energy; -reduce raw material input; -reduce pollution; -minimize waste disposal costs and problems; -generate income through sales of wastes; -diversify into new products. To find out more, call the WasteLine: Phone: (204) 257-3891, call collect in Manitoba, Manitoba Waste Exchange, 1329 Niakwa Road East, Winnipeg, Manitoba, R2J 3T4.

Fuel From Municipal Waste

by Pamela Shimell former editor
"Waste" London

Municipal waste is one commodity certain to remain plentiful in all parts of the world so any means of using it profitably can only be worth serious consideration. An ideal use could be to extract fuel from the waste for industrial applications and this is a process that involves mechanical separation and pelletisation, something that is technologically feasible but not yet carried out on the kind of scale it might be.

While the idea has been tried in the United States of America, Sweden and West Germany in particular, it is probably true to say that nowhere has the technology been developed to a greater extent than in the United Kingdom. There the British Government has been actively involved through the Departments of the Environment and Trade and Industry, the latter through its Warren Spring Laboratory (WSL)⁽¹⁾, north of London.

Early pilot plants at WSL and Chichester, in southeast England, were followed by the decision to build two experimental mechanical separation plants in the north of the country at Doncaster and Newcastle, the latter being known as the Byker plant. The government invested heavily in both, with the aim at Doncaster being to carry out the maximum amount of materials separation prior to pelletisation, while at Byker it was to recover fuel and ferrous matter. All incoming refuse was to be immediately pulverised.

Agreement was given for these plants in 1976, but they were not built and commissioned until 1979/80 and a considerable amount of experience has been gained since then, although neither plant has been able to sustain three-shift operation due to technical and marketing difficulties.

New Plants

Several years of experience and extensive modifications now place these plants at the point of technical and marketing take-off. The marketing has produced its own experiences — not least in the suggestion of the type of pellet acceptable to industrial customers.

WSL's role is in the modification and

monitoring of the two plants and their pellet products. The experience gained has also been used in the construction of two new mechanical separation and pelletisation plants. These have been built on Merseyside, in northwest England and at Castle Bromwich in the midlands, with private sector involvement in the former case.

The first lesson learned was that the

incoming refuse needs to be dried if pellets are to be produced from the combustible fraction of the refuse. This was not done in the Doncaster and Byker plants initially. At Merseyside and Castle Bromwich, rough pellets produced in the primary pelletisers are dried in a cascade dryer with heat supplied by fluidised bed units which are themselves heated by the plant's pellets.



The Byker mechanical separation plant in northeast England, which now has six years operating experience.

This results in a product that is a loose refuse derived fuel in its own right or can be put through a secondary process to produce harder pellets for sale as ch. These will be easier to handle, transport and store. But the two stage pelletisation process, with a drying stage in between, keeps the options open as to what kind of refuse derived fuel product is available.

Fluidised Bed Combustors

Drying proved an essential part of the process as it was discovered that the ideal pellet should contain only 10 to 15% moisture if it was to retain its integrity. Early trials at the Castle Bromwich plant produced pellets with a moisture content of 4%. This went to the other extreme and was probably too dry to burn well, so Castle Bromwich will be aiming for more moisture in the finished pellet. Over the past decade it has also been found necessary to fine tune mechanical separation plants according to the characteristics desired in the end products.

Castle Bromwich and Merseyside are the only plants with fluidised bed combustors being used to dry the refuse derived fuel product. Part of WSL's involvement is to monitor the emissions and performance of the fluidised units manufactured by the company Babcock Worsley⁽²⁾.

The two stage pelletisation process was developed by Simon Barron⁽³⁾ and consultancy Henley Burrowes⁽⁴⁾, which has been involved with the Byker plant since the early days.

Several explosions at the Byker plant have led to blast-proof units being fitted in certain areas. A simple can of paint thinners exploding in the pulveriser was enough to cause considerable damage and costly downtime.

Too much glass in the pellet, caused by pulverising the whole refuse input with insufficient glass removal, has been shown to cause excessive ash when the pellets are burned. One solution developed at Byker was to install a ballistic separator which, together with the twin chute feed system on the final pellet mill, has doubled the life of the dies and rollers per tonne of fuel produced. This has increased from 900 tonnes per die, and 500 tonnes per roller to over 2,500 tonnes for the former and 2,000 tonnes for the latter.

Ash Content

7th dies costing up to £3200 in Britain and roller shells £330 each, "such savings", says a recent WSL report, "are not insignificant. The fuel and energy used by Byker between 1982 and 1984 have also been reduced: some 10% reduction in propane usage per tonne

of fuel produced and a reduction of over 30% in specific power consumption in terms of both input feed and final pellet production."

It has been found that the ash content in pellets is related to the efficiency of removing fines. Ash content at these plants is generally 12 to 15%, although Castle Bromwich claims to have achieved 6%. The calorific value of the fuel varies from about 2.87 MJ to 4.3MJ per kilogram compared with around 5.74 MJ/kg for coal.

Research is going on into the use of materials rejected from the mechanical separation plants for use in soil conditioning, but it is doubtful whether there would be a market for them in the United Kingdom other than for landfill cover or landscape gardening uses.

There are now two other separation plants in Britain, one at Eastbourne, on the south coast, and one at Glasgow in Scotland. These have been developed without WSL involvement although the laboratory is due to carry out tests at the Glasgow plant. They are also more selective about the incoming waste they accept and have a better quality refuse derived fuel product, having undergone fewer ash problems earlier in the production line. They dry the material and employ only one stage pelletisation, this being considered sufficient.

Emissions Monitoring

Much of WSL's work in this area is now devoted to monitoring emissions from the combustion of refuse derived fuel pellets. Facts are being compiled so that suitable emission control standards can be formulated.

WSL is now studying eight boiler plants: two fixed grates; an underfeed stoker; a chain grate; two fluidised beds; a starved air incinerator; and a shell boiler. Trials have also been conducted using mixtures of pellets and a coal dust and loose refuse derived fuel mixed with coal. To obtain a base line comparison, the fuel has been compared with coal combustion; sulphur emissions are lower but those of chloride and heavy metal are higher.

Chloride emission could be reduced, it is believed, by adding a reagent to fix it in the ash, or by additional pre-sorting to remove PVC, although this is only one source of chloride in refuse. Similarly, heavy metal emissions could be reduced by improved sorting or mechanical separation of the light combustible fractions.

More research is being carried out into the presence of trace quantities of potentially toxic hydrocarbon or chlorinated compounds such as dioxins.

Methods for measuring organic emissions are being developed and information is still being collected. However, these emissions do relate more to the efficiency of combustion and can be expected to improve as more is learned about the burning of refuse derived fuel.

While a government owned research establishment, WSL is active in a consultancy capacity and has produced reports for the European Community and private companies. Its activities extend beyond the area of waste management and it has a unique experience on which to draw.

Addresses

1. Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Hertfordshire, England, SG1 2BX.
2. Babcock Worsley Ltd., Worsley House, Liverpool Road, St Helens, Lancashire, England, WA10 1PQ.
3. Simon Barron, Bristol Road, Gloucester, England, GL2 6BY.
4. Henley Burrowes, Sunnyside Road, Brabourne, Worcester, England, WR1 1RJ.

Haz-Waste

Disposal Plan

The province of Manitoba is seeking public input on a proposed \$25 million hazardous waste disposal system that will cost \$4.7 million a year to operate when it is brought into service in the early 1990s. The provincial proposal calls for the neutralization in the early 1990s. The provincial proposal calls for the neutralization and storage in landfill sites of 75 per cent of the 20,000 tonnes of hazardous wastes generated annually in Manitoba. The remaining 25 per cent, mainly flammable material, would be sent to Ontario for incineration.

In conjunction with the disposal system new stringent regulations will be in place in the new year to monitor the nature and quantities of hazardous materials generated by industries in the province. The regulations will establish a mandatory registry of all hazardous and toxic wastes. Firms will have to submit detailed information on the nature and quantity of wastes they generate. The new regulations also call for the documentation of shipments of hazardous waste so the province can monitor the safe transportation and delivery of the material.



NEW MANAGER AT BIOMASS

Mr. Ted Speers, Chairman of the Board of Directors, Biomass Energy Institute, is pleased to announce the appointment of Dr. Beth Candlish as Manager of the Institute. Dr. Candlish replaces Mr. Peter Winter who has established his own consultancy business.

Beth is well known to agriculturists and has a formal education background in agricultural economics, plant biochemistry and animal nutrition as well as practical farming experience in Ontario and Saskatchewan. She has worked at the University of Manitoba, Animal Science Department most recently and her own consulting business. In the past, Beth has been employed by the Canadian Grain Commission, Canola Council of Canada and the Canada Grains Council. The wealth of agricultural experience Beth brings to her new position will be a tremendous asset to the Biomass Energy Institute.



Last month newly elected mayor Marvin Ryz declared Pinawa (pop. 2,100), 75 miles northeast of Winnipeg, ready and willing to provide the site for a \$35 million provincial government toxic waste dump, or rather, "management plant" as they say in Pinawa. The province produces 20,000 tonnes of industrial garbage annually and needs some place to put it. "Someone has to take responsibility for the stuff," reasons self-proclaimed environmentally-conscious mayor. "The problem won't go away."

The councillors also commended fellow Pinawians for their courage and concern. Councillor David Studham

People



SIMON FRASER UNIVERSITY vice-president Tom Calvert (center) holds token cheques making SFU a shareholder in patents developed by university researchers (l to r) Per Joensen, Robert Frindt, Mike Gee, Roy Morrison and Bijan Miremadi. Process developed by the SFU team deals with removing sulphur from petroleum before processing crude into gasoline or fuel oil. Removing sulphur before combustion takes away a major source of atmospheric contamination.

After four years as Executive Director with the Biomass Energy Institute, Peter Winter has resigned his position to concentrate on consulting and publishing activities. He will still be working with the Institute on various research projects.

Peter intends to publish books and periodicals in the energy and biotechnology fields.

said: "Society produces waste and derives benefits from it. It should take responsibility for it too."

Orangeville, Ontario

A cogeneration system utilizes a two-stage anaerobic digester to get optimum use of the gas produced at the Orangeville Sewage Treatment Plant. For information on articles in Network or the Municipal Energy Conservation Program, contact:

Robert Fine, Program Co-ordinator, Municipal Energy Conservation Program, Association of Municipalities of Ontario, 100 University Avenue, Suite 805, Toronto, Ontario M5J 1V6. Phone: (416) 593-1441.

Recycling grant for Alberta

A grant for an overall recycling project has been awarded under the Alberta Environment Resource Recovery Grant Program. Alberta Environment runs a variety of programs to encourage the recycling of resources such as paper, cardboard, lubricating oil and beverage containers.

For more information contact: Luanne Marks, Pollution Control Division, Alberta Environment 427-5868 or Janet Austin, Communications Branch, Alberta Environment 427-6267.