Strategic Alliance Opportunities

Quality Knows No Boundaries...

Canadian Technology, Products and Services

Solid Waste Management Industry

Canadian Partners for Global Markets

Canada

Solid Waste Management Industry

Canadian Partners for Global Markets

Cover photo courtesy of the National Capital Commission.

Strategic Alliance Opportunities

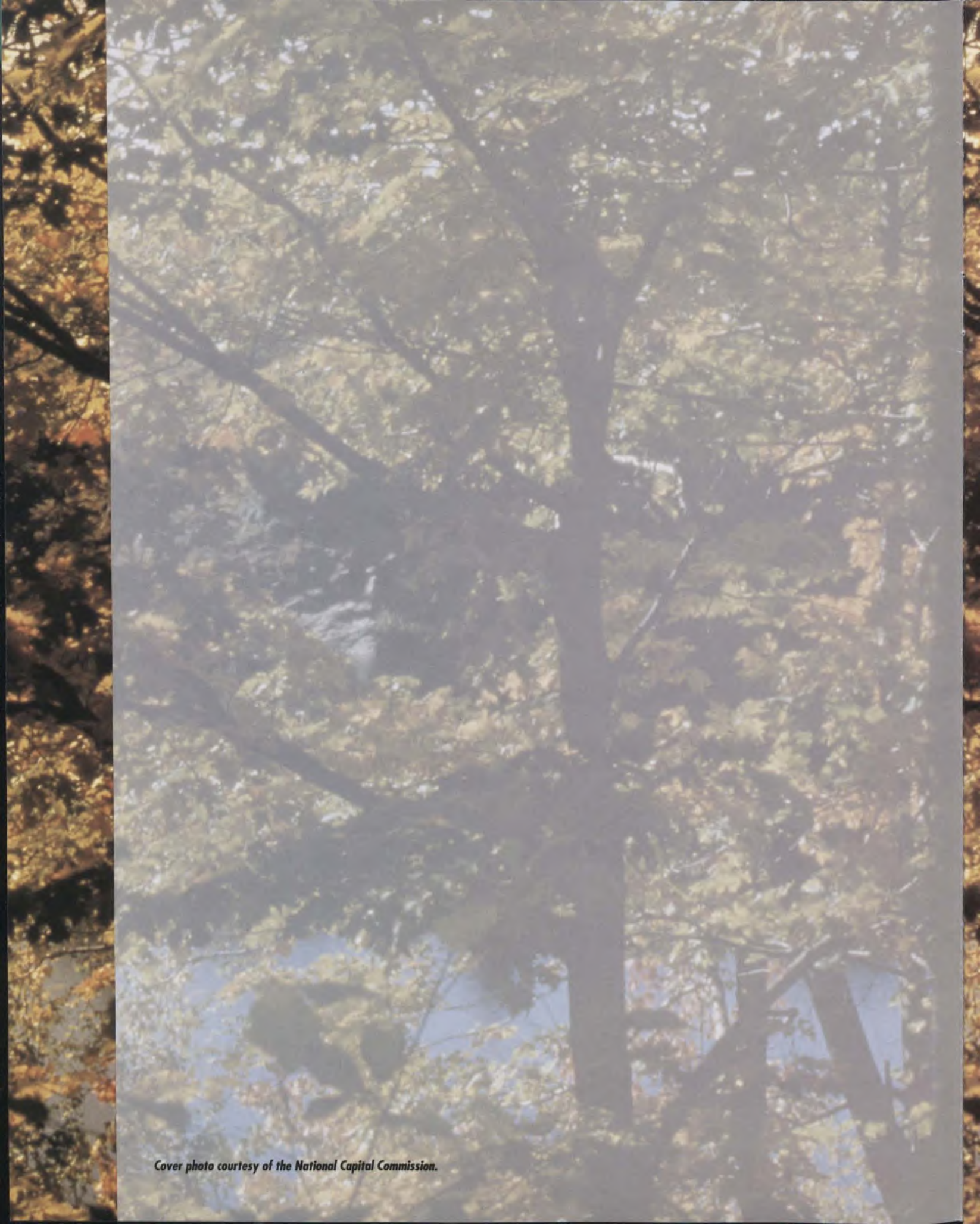
Quality Knows No Boundaries...

Canadian technology, products and services

Solid Waste Management Industry

Canadian Partners for Global Markets

Canada



Cover photo courtesy of the National Capital Commission.

THE CANADIAN SOLID WASTE MANAGEMENT INDUSTRY

Solid waste management is a strong, dynamic and key component of Canada's environmental sector. The federal government, in co-operation with the ten provinces, plays a lead role in the development of waste reduction programs and legislation. Canada's focus on the environment and its desire to improve Canadian competitiveness in the global marketplace is creating strategic alliance opportunities for Canadian and foreign firms to develop business partnerships at home and abroad.

As a result, the Canadian government is committed to supporting private sector growth in manufacturing, technology and services related to solid waste.

This document is created to help expand co-operation between Canadian and foreign firms. Several areas have been identified for growth potential. These include:

- industrial, commercial and institutional solid waste management
- state-of-the-art equipment manufacturing
- innovative collection, recycling and reduction technology
- consulting and other services

CANADIAN INDUSTRY FACTS:

- Canadian manufactured equipment and services related to solid waste are utilized worldwide.
- Regulation-driven, the industry is the most developed and one of the fastest growing in Canada's environmental sector.
- The 5-year growth rate is among the highest of any industry group, estimated at 7-10% annually.
- A growing trend in Canada is for municipalities to contract out waste collection services and the operation of recycling, reduction and resource recovery programs to the private sector.
- Private waste management enterprises generate annual operating revenues in excess of $1.1 billion.
- Canada and the majority of provinces have adopted a 50% waste reduction goal for the year 2000.
- Canada's Green Plan calls for an additional $10 billion in public and private sector expenditures to protect the environment by 1996.
- Canada generates 16 million tonnes of solid waste annually. Of that, 13 million tonnes are landfilled, 1.6 million tonnes are recycled and 1.3 million tonnes are incinerated.
- The Canadian waste stream is made up of 57% Industrial, Commercial and Institutional (ICI) waste, 33% residential waste, and 10% Demolition, Land Clearing and Construction (DLC) waste.

INDUSTRY OVERVIEW

The disposal of solid waste is managed through landfilling, recycling, resource recovery and incineration. The Canadian industry consists of companies specializing in a wide variety of services and equipment manufacturing. Services include collection, processing, reduction, disposal site operations, engineering, recycling and public involvement process consulting. Equipment manufacturers include firms which make recycling trucks, specialized trommels and glass and plastic recycling equipment.

Several factors contribute to the growing Canadian solid waste management market, including: an increasing urban population, higher waste generation rates (a 25% per person increase in the last decade), high value of land, closing of landfills and the high cost of transporting waste to distant landfill/incineration sites.

Many recycling programs are expanding to target an even greater variety of materials collected from the Industrial, Commercial and Institutional (ICI) and the Demolition, Land Clearing and Construction (DLC) waste streams. These programs are almost exclusively implemented and operated by the private sector.

DEVELOPMENT OF THE INDUSTRY

- In the 1970s many municipalities operated recycling bins or encouraged depots run by local companies. For the first time the concept of waste management, as opposed to waste disposal, was introduced. During this period, federal and provincial ministries of the environment were established.
- The increased pressure on landfills, due to closures and urban sprawl, spawned a diverse array of equipment manufacturing, waste management engineering, recycling, waste reduction and consulting services.
- In 1983, Canada introduced the first municipally co-ordinated residential curbside recycling collection program in North America. Today most major cities in Canada have residential multi-material curbside recycling collection programs.
- Canada's 1990 Green Plan identified waste management as one of the major environmental issues for Canadians.
- Increasing restrictions and monitoring, necessitated by strong public reaction to transporting waste out of local jurisdictions, have created a growing demand for local solutions to waste management problems. This demand is creating new opportunities for innovative equipment, services and technologies.
- The national focus on solid waste management has encouraged manufacturers to consider changes in two critical areas: design for recyclability and pollution reduction.

Bovar Inc. – Plant laboratory.

LEGISLATION AND THE MARKET

- The market for solid waste management products and services is primarily driven by legislation and regulation. As the foundation of its environmental program, Canada has the Canadian Environmental Protection Act (CEPA). Introduced in 1989, CEPA covers any release of toxic substance into the environment including air, land and water. CEPA imposes primary responsibility on Canadian industries for waste handling and practices and promotes a "cradle to grave" approach. As a result, CEPA promotes the development of new technologies, processes and services to deal with waste and waste disposal efficiently and effectively.
- In Canada, provincial governments set the standards for disposal of municipal solid waste and provide a regulatory function. Municipalities are responsible to manage the actual collection and disposal of waste. The current trend in federal and provincial legislation towards stricter regulations is creating increasing demand and opportunity for solid waste management equipment and services companies.
- In 1989, the Canadian Council of Ministers of the Environment (CCME) set a nationwide goal of 50% reduction by the year 2000 in the weight of waste sent for disposal, down from the 1988 estimated rate of 1.8 kg per person per day.
- In 1990, the federal and provincial governments, with the co-operation of the packaging industry, endorsed the National Packaging Protocol (NAPP), a policy designed to reduce packaging waste by 50% by the year 2000.
- A majority of Canadian provinces are reviewing and updating legislation surrounding solid waste management.
  - Ontario has developed the *Municipal Industrial Strategy for Abatement* (MISA), based on "Best Available Technology". Any municipality wishing to apply for provincial funding, or for a permit to site a new landfill, must develop a solid waste management plan according to provincial standards set within the "Waste Management System Planning" process.
  - British Columbia is currently drafting waste management legislation under the *British Columbia Environmental Protection Act* (BCEPA). The BCEPA will focus on the 5 R's - Reduce, Reuse, Recycle, Recover and Residual Management. Further, the Act will allow the government to enter into partnerships with companies.
  - Alberta's *Environmental Protection Enhancement Act* supports integrated waste management through privatization of operations and industry stewardship. The province has also initiated a "Recycling Industry and Market Development" program. There is funding available for consulting services in market research and development, and new product and process technology development.
  - In 1988, Quebec passed legislation aimed at reducing industrial waste production by 75% over a ten-year period. The province is conducting an extensive review of regulations concerning solid waste handling and disposal. This is expected to result in significant changes in the availability and use of sanitary landfill sites.
  - Manitoba has enacted a *Waste Reduction and Prevention Policy* (WRAP) statute in their waste management act. Similar initiatives are being examined in Saskatchewan, Alberta and other provinces. Under the Manitoba legislation, grants and other financial assistance may be offered to encourage WRAP.

INDUSTRY TRENDS

Today, municipalities in Canada are developing integrated approaches to waste management that they intend to follow during the next 10 to 20 years. These plans generally give priority to source reduction, reuse, recycling and resource recovery, including composting facilities for landfilling of residues.

- The province of New Brunswick has established a solid waste commission that will oversee collection, disposal, waste reduction, recycling and similar programs on a province-wide basis.
- The province of Quebec supports voluntary compliance with the Canadian Council of Ministers of the Environment (CCME) goals. In order to promote compliance, the Crown corporation, *Recyc Quebec*, provides funding to industry for recycling and waste recovery initiatives. The province has also initiated a comprehensive study of effective curbside recycling programs, in co-operation with municipalities and industry.
- In British Columbia, large regional districts are responsible for developing the solid waste management plans for the area. The plans have differing levels of government interaction between the regional districts and the municipalities. The province oversees the plans and ensures their compliance with provincial regulations and legislation. The province also provides capital funding to the regional districts to assist in the development of infrastructure.
- The province of Ontario has introduced the *Industrial Waste Diversion Program.* This will require businesses to perform annual mandatory waste audits and put together "action plans" to implement source separation of recyclables and maximize diversion from landfills. New opportunities will arise in the Institutional, Commercial, and Industrial (ICI) and Demolition, Land Clearing and Construction (DLC) sectors which, together, account for 60% of the 10 million tonnes of solid waste generated in Ontario annually. The new regulations are expected to be in place at the end of 1993.

Haul-All Equipment Systems – Depots are the ideal single method for total participation.

LANDFILLS

- 80% of all industrial and municipal solid waste in Canada is disposed of by landfilling.
- By 1995, 71% of Canada's existing landfills will be closed.
- Landfill requirements come under the jurisdiction of the provincial governments. As provinces develop new and more stringent requirements, landfills are becoming increasingly expensive to site, build, operate, monitor and manage after closure.

RECYCLING

- The most common family of materials in the Canadian waste stream is paper, representing over one-third of the total municipal solid waste. Currently 20% of this paper is recycled, 20% is unavailable for recycling and 60%, while recyclable, is landfilled.
- *The Canadian Waste Materials Exchange* (CWME) and provincial counterparts help industries get in touch with potential users or recyclers of wastes. Initiated in 1978, the CWME has assisted in the recycling and reuse of over 300,000 tonnes of waste from a variety of industries.
- Organic waste is the second largest component of the waste stream. Composting is rapidly becoming a key strategy in organic waste management - it has the potential to reduce the quantity of waste sent for disposal by 30%.

ENERGY RECOVERY

- There are 16 municipal solid waste incinerators in Canada.
- The Greater Vancouver Regional District (GVRD) incinerator, located in Burnaby, British Columbia, is the largest in Canada. It incinerates 220,000 tonnes of municipal and industrial solid waste per year. Steam generated from this facility is sold to a local paper recycling plant.

THE CANADIAN ADVANTAGES

Nine (9) reasons why your firm should join forces with a Canadian partner.

MARKETS

1. A strong and rapidly growing Canadian market for solid waste equipment and services.
2. Canada is well-positioned for market access to the United States and Mexico.
3. A freer flow of goods and services under the Canada-U.S.A. Free Trade Agreement.

CAPABILITY

4. International recognition of Canadian expertise in the solid waste management industry.

INDUSTRY-UNIVERSITY-GOVERNMENT LINKS

5. An extensive research and engineering infrastructure supported by public and private sector financing.
6. Strong government support for technology transfer, product development, export marketing and financing.

FAVOURABLE TAX STRUCTURE

7. Competitive tax mechanisms for research and development
8. Competitive corporate tax structures

TRANSPORTATION AND COMMUNICATIONS INFRASTRUCTURE

9. A cost-effective transportation and communications network.

Équipement Labrie Ltée – "TOP SELECT" recycling truck.

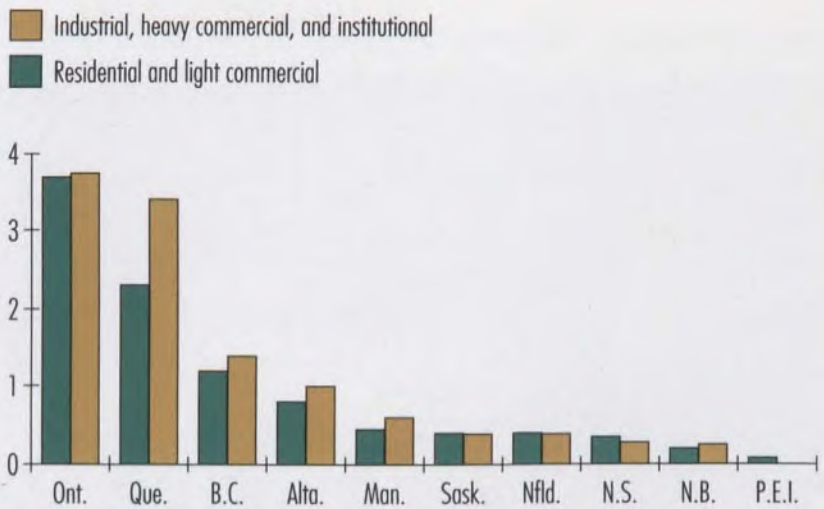
CANADA'S SOLID WASTE MANAGEMENT MARKET

- In 1992, the sales of solid waste management products and services exceeded $1.1 billion.
- The growth potential for the Canadian industry is estimated at 7-10% per annum and is expected to continue through the year 2000.
- Recycling and waste reduction represent key market opportunities over the next 5-7 years. There is mounting private and public pressure to reach the *Canadian Council of Ministers of the Environment* (CCME) goals — a 50% reduction by the year 2000 in the weight of waste sent for disposal.
- The demand for equipment, services and technology exceed the total industry's current capacity to deliver.

INDUSTRY CHARACTERISTICS

- Collection and hauling accounts for 72% of solid waste management revenues. The bulk of remaining revenues are generated through disposal, 21%, and recycling, 4%.
- Gross profit margins in the waste industry were approximately 29% in 1991.
- In the environmental sector, Canada is moving rapidly towards privatization of new and existing government services. Private firms already provide approximately 70% of the solid waste management services, including consulting services, in Canada.
- The private sector employs an estimated 100,000, the public sector an estimated 35,000.

The amount of solid waste (in millions of tonnes) generated in Canada in 1988, by province



Source: Canadian Council of Ministers of the Environment (CCME), 1989.

NORTH AMERICAN MARKET OPPORTUNITIES

- The combined Canada – United States market for solid waste management products and services exceeds US$30 billion.
- The market is expected to increase at 7-10% annually to the year 2000. The best opportunities will be in the areas of recycling, composting, and improved waste separation technologies — especially for plastics.
- In Mexico, the environmental industry has been targeted as a priority sector for development. The market for solid waste handling equipment totalled US$500 million in 1991, and is expected to grow at an average rate of 25% to the year 1995.
- In North America, in excess of 75 million tonnes of post-consumer recyclables were collected in 1990, a 5% increase from the previous year.
- During the 1980s, recycling accounted for 1% of North American plastic waste disposal. It is estimated that by the year 2000, this figure will increase to 43%.
- In 1991, in excess of 37 billion steel cans, or 2.8 million tonnes, were discarded in North America, representing 1.8% of municipal solid waste by volume.
- In 1990, the United States *Environmental Protection Agency* (EPA) estimated that US$115 billion was spent on environmental protection in the United States. In addition, the United States generates 180 million tonnes of municipal solid waste annually.
- The EPA predicts that by the year 2000, 25% of the municipal waste stream will be incinerated. This figure, up from 14% in 1990, suggests that incineration capacity will at least double over the next decade.
- Canada has a strong background in hands-on resource development in the areas of pulp and paper, mining, forestry, agriculture and utilities. These sectors offer vast potential for "value-added" economic environmental activity for both domestic/global market access and technology sharing.

AGRA Industries Limited – In Edmonton, producing polyethylene terephthalate (PET) from 100% post-consumer recycled beverage containers.

FREE TRADE AGREEMENTS

FREE MOBILITY OF ENVIRONMENTAL PRODUCTS AND SERVICES

Under the Canada/United States Free Trade Agreement (FTA), which came into effect January 1, 1989, all tariffs between Canada and the United States on environmental products, manufactured in either country, have been removed, or will be phased out, by 1999.

The North American Free Trade Agreement (NAFTA) between Canada, the United States and Mexico, will build on the FTA and create the world's largest free trade zone. NAFTA is due to start January 1, 1994.

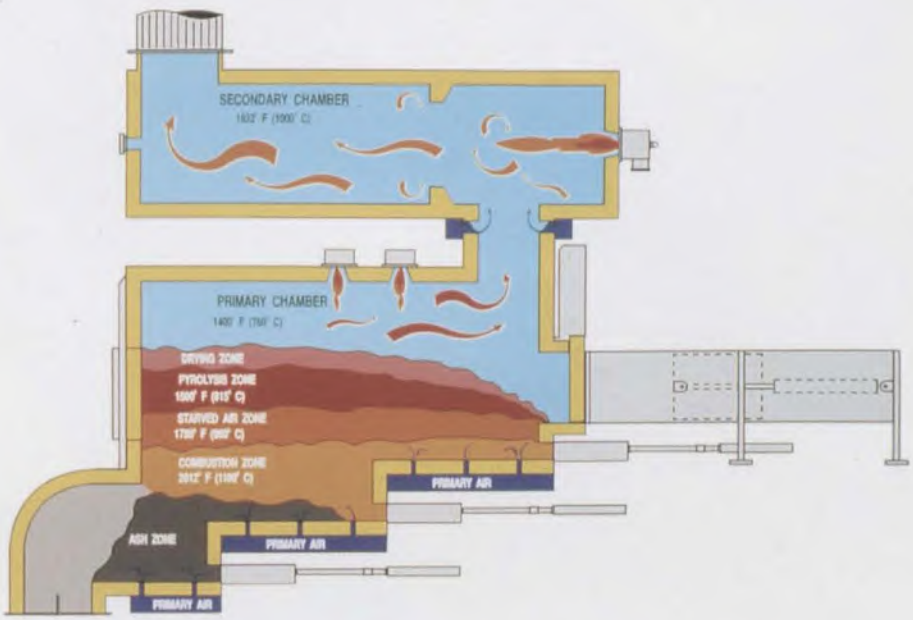
FREE MOBILITY OF NORTH AMERICAN BUSINESS PROFESSIONALS

The FTA permits unhindered reciprocal access for Canadian and American business people in marketing, sales and collaborative activities.

Research and professional staff engaged in the following general activities qualify for temporary entry:

- Research and design;
- Manufacturing and production;
- Installation and training; and,
- After-sales servicing.

The FTA is expected to increase economic growth, expand bilateral investment and trade in goods and services, improve job opportunities and enhance the competitiveness of both countries in world markets.



MBB-Trecan – Two stage controlled-air incineration process for treating biomedical waste.

RECOGNITION OF CANADIAN CAPABILITY

Canada has been at the forefront of the solid waste management industry in design and implementation of waste reduction, recycling and composting programs:

- Labrie Equipment (Beaumont, Quebec) is a world leader in the development and export of specialized recycling trucks.
- Mobile Computing Corporation (Toronto, Ontario) is developing the world's first vehicle-mounted computerized measuring system capable of weighing garbage. This technology will enable municipalities to implement "User Pay by Weight" concepts for municipal collection and disposal.
- Recovery Technologies (Mississauga, Ontario) has developed a cryogenic process for recycling tires which is being used in Italy and Switzerland.
- Canada pioneered the handling of aluminum processing residue using plasma-arc technology for worldwide markets.
- The Ontario Waste Management Corporation (Toronto, Ontario) pioneered both residential blue box programs for collecting sorted household wastes and industrial waste exchange programs. The OWMC was awarded the UN Environmental Achievement Award in 1989.
- The Saskatchewan government, in association with a number of rehabilitation centres for disabled persons, jointly developed SARCAN. This community-based enterprise has proven to be highly effective in the collection and processing of aluminum, glass, and plastic containers from the waste stream.
- British Columbia established the first beverage container refund program in the world in 1969.
- The Alberta Special Waste Management Corporation (Swan Hills, Alberta), a government-industry collaborative effort, operates North America's largest hazardous waste disposal facility.

The Alberta Special Waste Management Corporation (Swan Hills, Alberta).

RESEARCH AND ENGINEERING INFRASTRUCTURE

Institute	Area of Expertise
University of British Columbia	Environmental research and engineering
University of Guelph, Ontario	Waste matter, pesticide and pest control research
Saskatchewan Research Council	Environmental research
Ontario Waste Management Corp., Ontario	Industrial and hazardous waste management
New Brunswick Research and Productivity Council	Environmental engineering
Centre de la Valorisation de la Biomasse, Quebec	Composting research
Université du Québec à Montréal, Quebec	Environmental studies
Université de Sherbrooke, Quebec	Environmental studies
Alberta Special Waste Management Corp., Alberta	Hazardous waste management research
Alberta Oil Sands Technology and Research Association, Alberta	Petroleum waste research
Atomic Energy of Canada Limited, Ontario	Nuclear waste research
Pulp and Paper Research Institute of Canada (PAPRICAN), Quebec	Pulp and paper research, recycling
Canadian Plastics Institute	Plastic recycling research

Key Industry Affiliations

National Solid Waste Management Association (NSWMA)	Canadian Association of Recycling Industries (CARI)
Solid Waste Association of North America (SWANA)	Institute of Scrap and Recycling Industries (ISRI)
Canadian Environmental Industry Association (CEIA)	Society of the Plastics Industry of Canada (SPIC)
Canadian Society for Civil Engineering (CSCE)	Canadian Composting Council (CCC)
Ontario Waste Management Association (OWMA)	Environmental Services Association of Alberta (ESAA)
Recycling Council of British Columbia (RCBC)	Collecte Selective Quebec (CSQ)
Recycling Council of Ontario (RCO)	

FEDERAL SUPPORT

There are several federal, provincial and regional government programs aimed at assisting high-technology companies in Canada with technology transfer, product development and export marketing.

KEY FEDERAL PROGRAMS INCLUDE:

The Environmental Technology Commercialization Program (ETCP) provides leveraged funding to accelerate the development of commercially-viable environmental technologies. The program, which draws on $80 million of federal government funding, is administered by Industry, Science and Technology Canada (ISTC) with the support of Environment Canada and the Industrial Research Assistance Program of the National Research Council (NRC). Tel. (613) 954-3342

The Industrial Research Assistance Program (IRAP) is a National Research Council initiative that provides technical assistance to companies through a national technology network. This program provides facilities, equipment, technologies and funding for collaborative research projects between government, university or foreign laboratories, and companies located in Canada. The objective is to offer industry the means to commercialize the latest technical knowledge, inventions and scientific knowhow. Tel. (613) 993-7005

The Natural Sciences and Engineering Research Council (NSERC) delivers major programs in support of targeted research between the university community and other sectors of the economy. With more than $450 million, the NSERC program focuses on research personnel support, operating grants and equipment grants. Tel. (613) 995-6295

The Western Economic Diversification (WED) Program offers a variety of support mechanisms, ranging from small business assistance to systematic industry-wide programs. The WED program is targeted to projects that involve new products, new markets and new technologies, including import replacements and industry-wide productivity enhancements. Tel. (403) 495-4164

The Atlantic Canada Opportunities Agency (ACOA) Program offers seven main areas of assistance adapted to the special needs of Atlantic Canada. These are loan insurance, interest buy-downs, business support, studies, innovation assistance, new facility establishment, and new product expansion. Tel. (506) 851-2271

National Research Council of Canada – Solvent extraction soil agglomeration.

COMPETITIVE TAX MECHANISMS FOR R&D

A 1990 study by the Conference Board of Canada reveals that the Canadian corporate tax system provides greater overall incentive for companies to engage in R&D than do the tax systems of nine other leading industrial countries. The study shows that Canadian tax incentives for R&D can reduce the costs of doing $1.00 worth of research to $0.65, whereas U.S. incentives reduce the cost to only $0.97 (see graph below). Canada's tax credit allows a wider expenditure base when calculating R&D expenses than does the U.S. tax credit. Moreover, the U.S. tax credit is taxable.

At present, Canada's federal tax incentives include deductibility of current expenses (i.e. wages, materials) and capital expenses (i.e. machinery, equipment), with the exception of building expenses, which must be depreciated. A further 20% investment tax credit is available to all firms. Depending on where in Canada the R&D is carried out, you may be entitled to an investment tax credit of up to 30%. These federal initiatives, combined with significant provincial R&D tax incentives, make Canada's overall tax treatment of R&D the most favourable in the Western world.

A TEN-COUNTRY COMPARISON

Country	Cost ($)	Rank
Canada	0.657	1
Australia	0.703	2
Korea	0.805	3
France	0.813	4
United States	0.972	5
United Kingdom	1.000	6
Japan	1.003	7
West Germany	1.027	8
Italy	1.033	9
Sweden	1.040	10

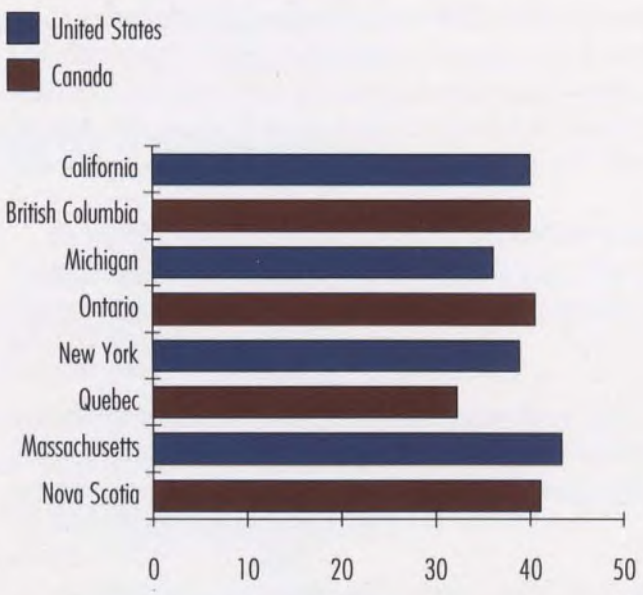
Note: Comparison based on the B-index method.
Source: The Conference Board of Canada Report 55-90, p. 13, May 1990

COMPETITIVE CORPORATE TAXATION

The Canadian corporate taxation system is highly competitive, providing specific advantages for companies with manufacturing or R&D activities in Canada.

The federal corporate tax rate for large manufacturing firms currently stands at 26%, with provincial corporate tax ranging from a low of 6.16% in Quebec, to 17% in Newfoundland and Manitoba. The table below provides a comparison of corporate taxation for large manufacturing firms (pre-tax income exceeding $200,000) in Canada and in the U.S.

Corporate Income Tax
Comparison of selected North American regions



Note: Canadian Tax includes Federal/Provincial; U.S. Tax includes Federal/States
Source: Deloitte & Touche, A Comparison of Tax Incentives for Performing R&D in Canada and the U.S., May 1990.

Corporate tax burdens as a percentage of GNP/GDP

Source: Department of Finance, Quartely Economic Review, Ottawa, June, 1991

TRANSPORTATION AND COMMUNICATIONS NETWORK

- Canada received the highest rating by the World Economic Forum for transportation, communications and power supply infrastructure among the G-7 countries in the 1990 survey of international business leaders.
- Canada features one-day air courier services across the entire North American continent with no customs delay.
- Canada has one of the most reliable and sophisticated telecommunications systems in the world, featuring integrated, privately owned, direct dial facilities with competitive prices across Canada and the world.
- There are common-carrier computer and electronic mail networks that span the Canada/U.S. border and cover the entire globe.
- All major Canadian cities are located within 24 hours' vehicle transportation of three-quarters of all major American cities.
- Canada's efficient transportation system features frequent air links between major metropolitan centres, with many non-stop morning and evening return routes.

INTERA TYDAC Technologies Inc. – Canada's map created in SPANS software.

A WIDE RANGE OF OPPORTUNITIES

As Canada moves into the 21st century it continues to play an important role in the global economy. The pursuit of strategic alliances promoting sustainable economic development remains the first order of business, domestically and worldwide, including developing countries and those in transition. Canada is internationally recognized for its clean environment and as a world leader in the promotion of conservation, waste management and pollution reduction. This arises from Canada's role in developing such agreements as the *Law of the Sea* and the *Montreal Protocol on Substances that Deplete the Ozone Layer.* Canada has generally avoided the adversarial approach between industry and government, favouring pragmatism and co-operation. These factors prompt companies worldwide to "think Canadian" when it comes to seeking expertise to solve environmental problems.

Solid waste management is a key component of Canada's environmental industries sector and offers major opportunities for partnerships and strategic alliances. We invite you to work with Canadian industry to exploit new opportunities, gain market access, technology and related investment benefits through industrial collaboration.

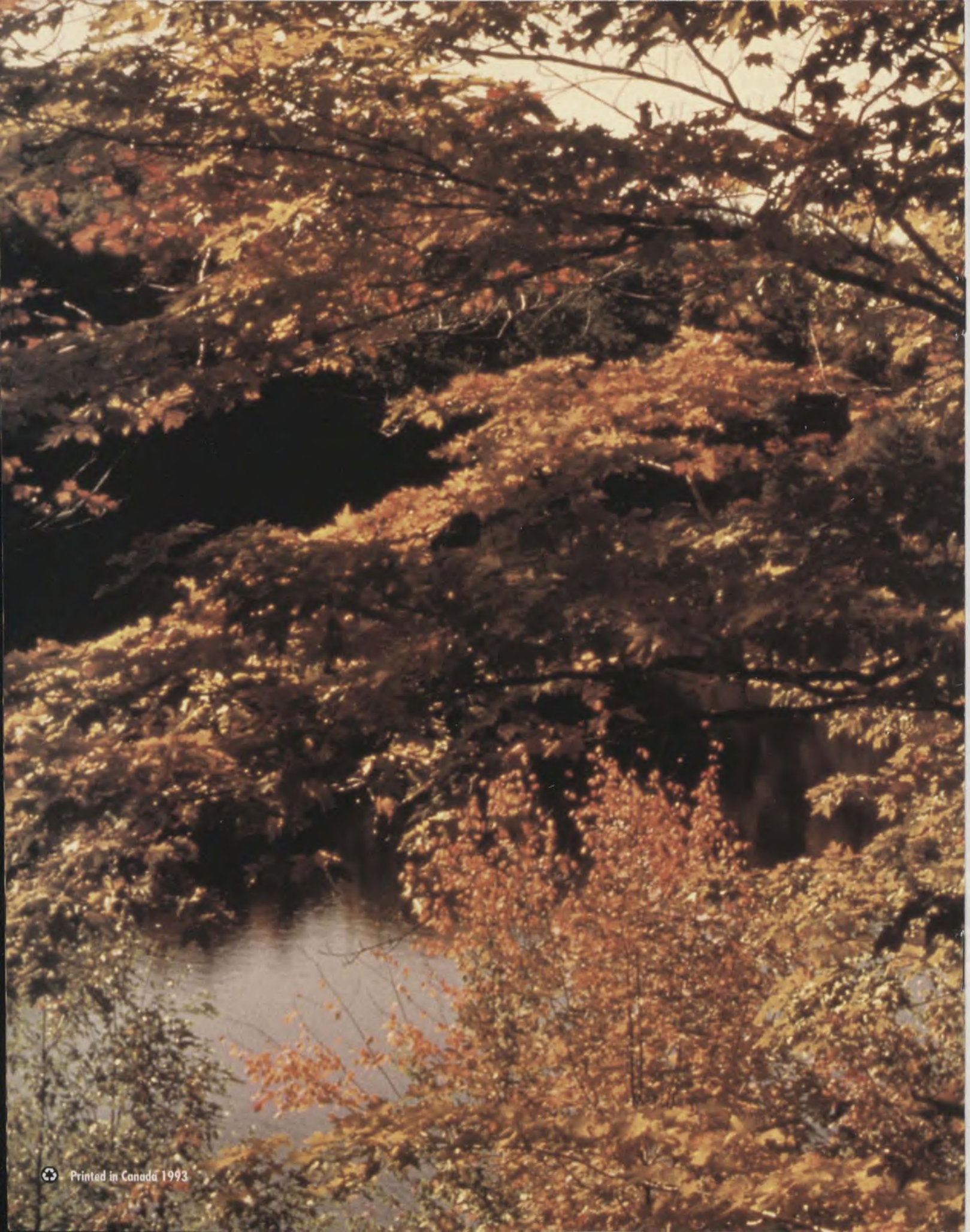
Additional detailed information profiling Canadian companies interested in strategic alliances is available upon request.

Investment Canada
P.O. Box 2800 Station "D"
Ottawa, Ontario, Canada
K1P 6A5
Fax: (613) 996-2515

Industry, Science and Technology Canada
235 Queen Street
Ottawa, Ontario, Canada
K1A 0H5
Fax: (613) 954-3430 or (613) 941-8464

UMA Engineering Ltd. – Aostra Taciuk processor for clean-up of P.C.B. contaminated soils.

Recovery Technologies Inc. – Cryogenic technology for tire recycling.



Printed in Canada 1993

AGRA RESOURCE RECOVERY AND RECYCLING GROUP

Suite 1900, 355 - 8th Avenue S.W.
Calgary, Alberta
CANADA T2P 1C9

Telephone: (403) 263-9606
Facsimile: (403) 263-9676

Key Personnel:
Bob Speed, Director, Corporate Development

Major Products/Services

Reverse Distribution Systems (private and public)
- collection of recyclables and used beverage containers
- processing and marketing of recyclables
- management services

Plastic Recycling (PET)
- flake
- cut or rolled sheet (clear, opaque and transparent)
- thermoformed items

Blow Moulded Containers (Custom Moulding and Labelling)
- up to 500 mL
- PET, PVC, PP, HDPE
- recycled resin capability (PET, HDPE)

Partnering Interests

Our company is interested in forming partnerships/alliances with organizations or individuals who have complementary business interests and/or exploitable technology in the areas of:
- collecting, sorting, processing or used beverage containers
- managing reverse distribution systems
- PET recycling
- manufacturing value-added products from recycled PET blow moulding recycled resins

Corporate History

Agra Resource Recovery and Recycling Group is a vertically integrated solid waste firm. Our business interests range from collecting, processing and marketing used beverage containers, to recycling PET plastic and manufacturing recycled PET sheet, and manufacturing small custom blow moulded containers.

- Revenue: Greater than $20 million
- R&D expenditure: $200,000 to $400,000
- Employees: 100
  Research and development: 3
  Marketing: 5
- Geographical markets: Canada, U.S.A., Europe, Asia, Mexico

Technological Expertise

Competitive advantage in our market niches is maintained by delivering proven, cost-effective solutions to both unique and day-to-day management problems.

Our advantages lie in:
- advanced collection information systems provide detailed cost data as required (onsite, material or brand basis; by weight or volume)
- superior quality control processing
- proprietary plastics recycling technology
- internal value-added markets
- superior manufacturing technology for utilization of recycled resins

PRODUCTS DEVELOPED

- Proprietary PET recycling technology
- Reverse Distribution System Management
  - information systems
  - management software
- Blow moulded containers, manufactured from recycled resins (HDPE, LDPE, PET)

BIOTHERMICA

3333, Boul. Cavendish, Suite 440
Montréal, Québec
CANADA H4B 2M5

Telephone: (514) 488-3881
Facsimile: (514) 488-3125

Key Personnel:
Guy Drouin

Major Products/Services

- Recovery and production of ethanol from low-cost hardwood
- Methanol production from biomass
- Recovery of energy from waste tires, coconut shells, bagasse, bark and wood waste using thermochemical processes such as incineration, pyrolysis, gasification and various biological processes such as anaerobic digestion, enzymatic hydrolysis and fermentation
- Site evaluation for landfill gas recovery
- Extraction testing
- Market surveys for the sale of LFG or energy
- Concept designs and cost estimates
- Technical and feasibility reports
- Recovery facilities monitoring, operation and maintenance
- Migration control investigation/system designs

Partnering Interests

Strategic alliances in landfill gas.

Corporate History

Incorporated in 1987, Biothermica is a Québec based company specializing in the development, design engineering and construction of waste to energy projects and chemical process plants. Areas of expertise: air pollution control (BIOTOX), landfill gas and energy from waste.

- Revenue: Greater than $1.8 million
- R&D expenditure: $600,000 to $800,000
- Employees: 22
  - Research and development: 10
  - Marketing: 3
- Geographical markets: Canada, U.S.A.

Technological Expertise

- Air pollution control
- Solid waste management
- Operates biomass gasification plant in the Québec City region
- Developed a high-efficiency biomass-gas scrubbing system for removing particulates and condensable tars
- Plant design
- Startup, commissioning and operation
- Design of biogas processing plants
- Energy recovery from waste and chemical process for petrochemical industry
- Landfill gas recovery and utilization assessment
- Waste-to-energy plant design, detailed engineering and commissioning
- Incineration and gasification process design and engineering

Products Developed

- Landfill gas
  - gas emission characterization
  - biogas production curve
  - biogas electrical power plant
  - biogas dispersion modelling
- Gasification
  - gasification/gas turbine process from solid waste combustion
  - electricity from waste through combustion process and steam turbine

Products in Development

- Landfill gas
- Gas turbine/biomass gasification process
- Experimental power plant to come

BIOWASTE MANAGEMENT LTD.

27715 Huntingdon Road, R.R. #5
Aldergrove, British Columbia
CANADA V0X 1A0

Telephone: (604) 856-6836
Facsimile: (604) 856-5644.

Key Personnel:
Rick Chose, President

MAJOR PRODUCTS/SERVICES

- Designs, develops, constructs, finances, owns and operates organic waste processing (composting) facilities, bagging plants and pelletizing mills.
- Produces organic horticultural soil products line
  - planting mixes
  - organic fertilizers
  - soil conditioners
- Develops and expands the sales and marketing of these products to domestic and international mass markets (retail, wholesale, etc.)

PARTNERING INTERESTS

- Joint-venture arrangements
  - develop new technologies
  - develop new facilities

CORPORATE HISTORY

- Consolidated Envirowaste Industries Inc., publicly traded, Canadian company, formed in 1986, organic waste reduction goals
- Biowaste Management Ltd., wholly owned subsidiary, formed in 1986, develops plants and products as outlined above.
- The Answer Garden Products Ltd., Biowaste's first plant, produces and markets products outlined above, formed in 1991.
- Revenue: Greater than $2 million
- R&D expenditure: $50,000 to $100,000
- Employees: 20
  Research and development: 2
  Marketing: 4
- Geographical markets: Canada, U.S.A.

TECHNOLOGICAL EXPERTISE

- The design and operation of in-vessel and windrow, environmentally positive composting plants on varying scales for a broad range of wastes under variable environmental situations.
- The development of practical handling processes for odours, leachates, emissions, etc.

PRODUCTS IN DEVELOPMENT

- Leachate treatment in environmentally sensitive areas.
- Low cost/waste unit processes technology for enclosed, in-vessel and aerobic composting.

GROUPE CHAGNON INTERNATIONAL LTÉE.

580 Montée St. Julie
Varennes, Québec
CANADA J3X 1S5

Telephone: (514) 652-9847
Facsimile: (514) 652-7326

Key Personnel:
Daniel Chagnon

MAJOR PRODUCTS/SERVICES

- Front end loader truck
- Rear end loader truck
- Roll-off truck
- Containers (all types, all forms, all sizes)
- Mining truck from 30 tonnes to 280 tonnes
- Pylon pole for electric wire

PARTNERING INTERESTS

- Establish local agent(s) to market Groupe Chagnon products and services.
- Joint-venture arrangements.

CORPORATE HISTORY

Groupe Chagnon International is a division of Groupe Chagnon, a Canadian and family-owned company established in 1961.

The company's structure and activities are grouped under environmental, industrial and equipment. The Environmental activities are carried out by four company divisions:

- Chagnon International Ltée.
  -Sale of solid waste management equipment
  -Exportation and technological transfer in solid waste management
- Gestion des dechets Biomed Inc.
  -Pick-up, transport and dispasal of biomedical, radioactive and chemical wastes
- Chagnon Transport Inc.
  -Transport of industrial, commercial and toxic wastes
  -Transport of hazardous wastes
  -Rental and sale of contyainers of all kinds for waste management
- Transport of hospital wastes

The manufacturing of solid waste management equipment (compactors, roll-off containers, waste containers, rear- and front-end trucks, etc.) is carried out by the industrial division – Les Soudures Chagnon Ltée.

- Employees: 400
- Revenue: Greater than $25 million
- R&D expenditure: $200,000 to $400,000
- Geographical markets: Canada, U.S.A., Mexico, Africa, Colombia, Ecuador, Chile

TECHNOLOGICAL EXPERTISE

We have manufactured environmental trucks for 33 years and managed our own garbage trucks for 20 years.

We've developed the garbage trucks by increasing the capacity; compaction is up to 10% more than any other company. Many options for our competition are standard for us.

PRODUCTS DEVELOPED

- Monufocture oll kinds of environmental trucks
- Mining truck
- Pylon for electric wire

PRODUCTS IN DEVELOPMENT

- Mobile woste transfer platforms
- New hydraulic compacting systems.
- Compactor with larger capocity
- Development of new technology equipment
- 80% of the bio-medical waste transportotion in Québec
- Refinery maintenonce
- Construction work
- Modify, repair, and moke heavy duty equipment

ENVIRONMENTAL TECHNOLOGIES INC.

#12, 1235 - 64th Avenue S.E.
Calgary, Alberta
CANADA T2H 2J7

Telephone: (403) 253-1616
Facsimile: (403) 252-1136

Key Personnel:
Richard Collens, President

Major Products/Services

ETi offers the services of evaluating the potential for utilizing the gas generated from solid waste landfills. ETi also offers a proprietary gas treating process and operational expertise. ETi has considerable experience in placing landfill gas utilization projects on stream.

Partnering Interests

ETi is seeking strategic alliances with foreign firms specializing in gas engines/specialized processing of low-quality BTu gas streams. Also of interest would be joint-venture opportunities with energy consumers of electrical/natural gas for the development of low BTu reserves (landfill gas/coal gas/ methane).

Corporate History

Environmental Technologies Inc. (ETi), Calgary, Alberta is an environmental company primarily engaged in the utilization of gas extracted from landfill sites as an alternative energy source. Formed in 1986, it is a public company trading on the Alberta Stock Exchange. ETi has put together a strong management team of highly qualified engineers and technicians with many years of experience in the oil and gas and energy related industries.

- Revenue: $1.7 million
- Employees: 5
- Geographical markets: Canada, Europe, U.S.A., Asia, Africa

Technological Expertise

ETi possesses landfill gas processing expertise and operational knowledge with a commercial landfill gas utilization project. ETi has three technical staff and extensive knowledge on all aspects of landfill gas.

Products Developed

ETi offers a proprietary landfill gas treatment process to the solid waste management industry. ETi also offers the expertise and equipment to assess the potential of solid waste landfill gas utilization.

Products in Development

- Negotiating with municipalities and landfill owners to acquire the gas rights to their sites.
- Evaluating potential use of landfill gas for production of methanol, low emission synthetic diesel fuel, and compressed natural gas engine fuel.
- Has formed a joint venture with Tai Energy Resources Inc. of Calgary and Victoria Mining Service (Nova Scotia), to utilize coalbed methane gas as an alternative energy source.

GARTNER LEE LIMITED

140 Renfrew Drive, Suite 102
Markham, Ontario
CANADA L3R 8B6

Telephone: (905) 477-8400
Facsimile: (905) 477-1456

Key Personnel:
Bob Leech, Vice-President

MAJOR PRODUCTS/SERVICES

Environmental Science, Engineering and Planning expertise includes:

- hydrogeology
- engineering geology
- environmental planning
- terrestrial biology
- chemical engineering
- environmental economics
- environmental geotechnique
- geology
- civil engineering
- aquatic ecology
- agriculture
- hydrology
- geophysics
- G.I.S.

Services

- site assessment
- social impact assessment
- public involvement
- waste reduction planning
- operations planning & implementation - site remediation
- strategic planning
- compliance monitoring
- emergency response planning
- facility auditing

PARTNERING INTERESTS

Gartner Lee Limited has a long-term interest in contributing towards the sustainable development of key foreign markets through the sharing of its environmental management expertise and technology. More specifically, GLL is seeking to establish a working relationship with suitable local consultants (to be determined) who will be effective in marketing its services locally and who will use GLL as a member of their project teams.

Gartner Lee is interested in a joint-venture agreement with local firms on a project by project basis or on a more formal basis.

An ideal partner would have the following characteristics:

Reputable multidisciplinary engineering consulting firm who recognizes the need for advanced environmental services, provides complementary services to GLL and has a well-established market share and marketing capabilities.

CORPORATE HISTORY

Gartner Lee Limited, incorporated in 1972, is a science-based consulting firm, with fully integrated in-house planning and engineering capabilities, which specializes in environmental problem solving. The firm is wholly Canadian owned and managed and is licensed by the Association of Professional Engineers of Ontario. Staff members are also licensed in Saskatchewan, Alberta and British Columbia. Head office is located in Markham, Ontario and branch offices are located in Vancouver, B.C. and Niagara Falls, New York. Subsidiaries of Gartner Lee Limited include: Gartner Lee Inc., Gartner Lee International Inc., and Environmental Strategies Limited.

- Revenue: Greater than $10 million
- R&D expenditure: $100,000 to $250,000
- Employees: 115
- Geographical markets: Canada, Europe, U.S.A., Asia, Middle East

TECHNOLOGICAL EXPERTISE

Gortner Lee hos successfully completed over 3,000 projects throughout Canada, the United States, South America, Europe, Southeast Asia and the Middle East. The firm is well recognized both domestically and intemationally far solving problems with COMPLEX soils, woter contaminotion and waste management.

Solid waste management experience includes municipal, industrial, hozardous and radioactive wastes. A professional staff of over 80 scientists, planners and engineers have assisted more than 50 municipalities with oll aspects of waste management from facility siting and design to site cleanup, closure and land transfer.

Extensive hazordous woste management expertise includes:

- Ontario Waste Management Carporotion Hozardous Waste Treotment Focility siting
- Deep Rock Hydrogeologic Testing for nuclear woste disposal for the federol governments of Canada, West Germany ond Switzerlond
- Assessment and remediotion of over 100 internationol chemicol, petrochemical and monufocturing woste disposal sites

PRODUCTS DEVELOPED

Speciolized environmentol consulting services to the solid woste management industry include:

- pocker testing
- leachote collection system design
- cover design
- londfill siting, expansion, closure, enviranmental approvals, planning and facilities design
- ground and surface water monitoring
- contaminant modelling
- landfill design
- facility operations planning and implementation
- site remediotion
- ecologic/geologic site assessment
- ground water modelling
- londfill complionce and regulatory guidance
- waste reduction, reuse, recycling

PRODUCTS IN DEVELOPMENT

Ongoing R&D octivities of Gortner Lee Limited are project specific and indude the following:

- woste and ground water model development for Atomic Energy of Conado's low-level radiooctive waste sites
- bioremediation of PCB contominoted soils (controct pending)
- wetland treatment of cyonide wostes

HAUL-ALL EQUIPMENT LTD.

4115 - 18th Avenue North
Lethbridge, Alberta
CANADA T1H 5G1

Telephone: (403) 328-7788
Facsimile: (403) 328-9956.

Key Personnel:
Richard Morosini

Major Products/Services

HAUL-ALL Equipment Ltd. specializes in refuse handling and recycling equipment; specifically truck-mounted packer and recycling bodies, transfer trailers, transfer stations, as well as refuse and recycling containers. Its products have gained wide acceptance with all sizes of contractors as well as in towns, municipalities and cities, and are widely used in provincial and federal parks throughout Canada and the United States. There has been steady growth in the product line, as the company establishes a more complete line of solid waste and recycling systems.

Partnering Interests

We have a licence in Sacramento, California. We would be interested in licensing and/or joint ventures.

Corporate History

HAUL-ALL comes from a long family tradition with over 60 years of experience in steel fabrication, manufacturing and design. The company has an excellent reputation in these areas and a long list of satisfied customers to back up their innovative product line. The company occupies a 5,575 square metre building located on 2.3 hectares of land in the industrial park area in Lethbridge, Alberta. This modern facility includes 595 square metres of air-conditioned office space located on two levels. The plant is well serviced by both truck and rail. With 65 to 70 employees currently producing a wide range of products, the facility looks forward to accommodating significant increases in volume.

- Employees: 65
- Geographical markets: Canada, U.S.A., Caribbean

Technological Expertise

All products are patented worldwide, with designs here through our engineering department. We are front runners in the recycling area.

Products Developed

- Transfer stations which are modular and self-contained
- Refuse containers with easy access, etc.

Products in Development

We are currently creating new vehicles in the recycling industry for two-stream collection.

LABRIE EQUIPMENT LTD.

175 route du Pont
St. Nicolas, Québec
CANADA G0S 2Z0

Telephone: (418) 831 8250
Facsimile: (418) 831 5255

Key Personnel:
Claude Boivin, President
Andre LeFebvre, General Manager

Major Products/Services

Labrie manufactures and distributes equipment for waste (refuse) and recyclable collection. Labrie's Top Select truck is a hydraulic loading recycler with distinct compartments to avoid contamination. Labrie's 200 sidelooder truck is a unit for collecting and packing domestic refuse.

Partnering Interests

Labrie is looking for a joint venture to market, sell and install bodies on cabs and chassis in different markets (Europe, Pacific Rim, etc.).

Corporate History

The growth began in 1971 with heavy goods vehicles. In 1984, the company introduced a collection box with adjustable compartments which made it possible to pick up and sort waste at the same time (this is still 12% of Labrie's production). In 1986, Labrie introduced the first hydraulic loading recycler.

- Annual Revenue: Greater than $20 million
- R&D Expenditures: $500,000 to $750,000
- Employees: 100
  - Research and development: 6
  - Marketing: 9
- Geographical markets: Canada, U.S.A.

Technological Expertise

With a strong multi-disciplinary team and innovative computer-assisted design, Labrie leads in practical design and sturdy construction of avant-garde products used in recyclable waste collection.

Products Developed

Hydraulic loading recycler - system raises the recycling containers over the top of the truck and unloads into corresponding compartments inside (up to six distinct compartments); optional addition of plastic crusher; vehicle can be adapted to commercial collection.

Side-loading collection truck - for collecting and packing domestic refuse.

Refuse transport trailer - capable of holding 30,000 kilograms of waste (equal to four truckloads) with a walking floor - can be unloaded in four minutes.

Products in Development

- Complete automated arm to load truck (refuse)
- Three streams refuse/recyclable body

MBB-TRECAN INC.

2150 Dunwin Drive, #3
Mississauga, Ontario
CANADA L5L 5M8

Telephone: (905) 607-5905
Facsimile: (905) 607-5908

Key Personnel:
Ken Lui
Scott Kerr

MAJOR PRODUCTS/SERVICES

The product range includes:

- incineration systems for
  - medical waste
  - pharmaceutical waste
  - industrial solid waste
  - low level radioactive waste
  - industrial liquid waste
  - fumes and gases
- high efficiency industrial burners
- snow melters
- direct fired air heaters
- submerged combustion equipment

PARTNERING INTERESTS

The company's main priority is to establish sales agencies or licensees for China, Thailand and Indonesia with the emphasis being on the incineration of medical waste.

CORPORATE HISTORY

Trecan was established in 1962 as the Canadian subsidiary of Thermal Research and Engineering Corporation of Conshohocken, PA, U.S.A. (currently T-Thermal Inc.) and in the years through 1965 it operated primarily as a sales outlet for Thermal's products in Canada. From 1966 the company began to expand its own engineering staff and develop a range of products which were to be subsequently manufactured in Canada.

On October 1, 1992, Trecan and MBB Mechanical Services Limited merged into a single company, MBB-Trecan Inc. Engineering and administration functions are now based in Halifax County, Nova Scotia, with sales, marketing and product development operating from its Mississauga, Ontario office. Manufacturing is undertaken in both Ontario and Nova Scotia.

Licenses or exclusive sales agreements are in place with T-Thermal Inc. (U.S.A.) and BP International (U.K.)

- Annual Revenue: $25 million
- Employees: 25
- Geographical Markets: The traditional market has been 80% Canada, 15% U.S.A. and 5% other exports, however, a substantial effort has been directed towards export sales since 1989. More recently those efforts have been expanded to include both the United States and the United Kingdom for medical waste incineration systems. Asian markets are now being developed and incineration systems have been sold in Taiwan and Korea. Other industrial combustion equipment has been sold in Japan and South Korea.

TECHNOLOGICAL EXPERTISE

Trecan specializes in the design, manufacture, installation, commissioning and service of industrial combustion and incineration equipment and systems, as detailed below.

There are two distinct product groups:

MBB Group: Repair, construction and manufacture of steam boilers to ASME codes

Trecan Group: Manufacture, installation and servicing of industrial combustion and incineration equipment and systems

NORTHSIDE/WITTKE STEEL FABRICATORS LTD.

1400 Industrial Road
Kelowna, British Columbia
CANADA V1Z 1G5

Telephone: (604) 769-4001
Facsimile: (604) 769-3979

Key Personnel:
Mr. Basil Carter, President and CEO

Major Products/Services

Trucks
- Front load packer
- Side load packer
- Auto-side load packer
- Over-the-top recycler
- Burro unit
- Super-burro unit
- Complete family of garbage

Systems
- Recycling
- Composting
- Biomedial waste

Partnering Interests

- Looking for reputable local companies to provide greater access to new markets for Northside/Wittke product line.
- Joint-venture arrangements related to solid waste handling and recycling expertise.

Corporate History

Northside was founded in Kelowna in 1968 as a small metal fabricator. In 1989, Northside acquired Wittke Iron Works Co. Ltd. from Lorence and Gene Wittke. Today, Northside Steel Fabricators Ltd. is a diversified metal fabrication company with operations in Kelowna, British Columbia and Medicine Hat, Alberta.

Kelowna Division supplies parts and components to truck and heavy equipment manufacturers. In addition, it provides specialized products to a wide range of customers in the waste management, material handling and aerospace support sectors.

Wittke Division in Medicine Hat manufactures a line of equipment for the solid waste industry. This line includes containers, compactors and truck bodies. Wittke is one of the largest manufacturers of solid waste management equipment in Canada.

- Revenue: Greater than $17 million
- R&D expenditure: $100,000 to $160,000
- Employees: 185
  - Research and development: 3
  - Marketing: 2
- Geographical markets: Canada, Europe, U.S.A., Asia, Mexico

TECHNOLOGICAL EXPERTISE

Northside Steel Fabricators Ltd. is a multi-divisional company which designs, engineers and manufactures the most complete line of waste handling and recycling equipment available on the market today.

The in-house engineering talents and expertise of the Northside/Wittke team allows for custom material handling solutions to be designed and built. Using current generation CAD technology, our engineering and design staff have fully modularized our drawings and manufacturing. It is with this capability that we are able to differentiate ourselves from our competitors. Unlike other companies who only sell parts and components, Northside/Wittke supplies solutions.

Provision of "Turnkey" systems:

- recycling stations
- transfer stations
- composting facilities
- bio-waste systems

PRODUCTS DEVELOPED

Equipment, systems and solutions for the waste management industry:

Garbage trucks
Recycling trucks
Compactors
Balers - horizontal and vertical
Waste containers in all sizes
Roll-off trucks
Recycle containers in all sizes
Turnkey - in-house waste management systems

PRODUCTS IN DEVELOPMENT

"Fly-by-wire" garbage truck controls
Biomedial waste management system for Taiwan

PYROTECH ASPHALT EQUIPMENT MFG. CO. LTD.

90 Harbour Avenue
North Vancouver, British Columbia
CANADA V7J 2E1

Telephone: (604) 988-5569
Facsimile: (604) 988-6368

Key Personnel:
Al Rorison, President

Corporate History

Began manufacturing, in January 1989, of the two-stage hot in-place recycling system prototype built in 1986. Continues R&D efforts which most recently have included the development of a fully mobile emissions control system. Began long-term research program in 1990. Sponsored and co-ordinated two international conferences on HIP recycling. Developed a one-day training seminar which is conducted in various regions.

- Revenue: Greater than $4 million
- R&D expenditure: $250,000 to $300,000
- Employees: 31
  Research and development: 8
  Marketing: 3
- Geographical markets: Canada, U.S.A., Europe, Asia, Mexico, Latin America, South America

Major Products/Services

- Manufactures the Pyropaver 300E hot in-place asphalt recycling system;
- Education and training of pavement design engineers and technicians;
- Project development assistance.

Technological Expertise

The innovative two-stage recycling process has vastly improved the quality of recycling of asphalt pavements. The chief benefit in consideration of waste management is the reduction of discarded asphalt in landfills. Pyropaving is a new alternative for maintenance and rehabilitation of streets, highways and airport runways.

Partnering Interests

- Pyrotech is keenly interested in technology transfer and promotes where possible the involvement of asphalt research laboratories in the performance studies of hot in-place recycling. The desired alliance is between a bonafide engineering facility, or government pavement managers.

- Pyropaver equipment operators to perform demonstration work and engineers experienced with the hot in-place process and product. (Pyrotech has presently established a research link between the University of Stockholm and the University of Nevada-Reno.)

Products Developed

Pyropaver series of hot in-place asphalt recycling system; equipment heats asphalt on the road, picks it up, mixes it, and spreads it back on the roadway. Boasts virtually smoke-free operation due to a complete emission control system.

Products in Development

Pyrotech continues ongoing R&D activities to improve recycling applications through the use of special additives (such as crumb rubber from tires which also poses serious problems for the solid waste manager) and to design equipment features which will increase the depth of operation.

RECOVERY TECHNOLOGIES INC.

5925 Airport Road, Suite 612
Mississauga, Ontario
CANADA L4V 1W1

Telephone: (905) 672-9448
Facsimile: (905) 673-8538

Key Personnel:
George Morrison, Chairman

MAJOR PRODUCTS/SERVICES

Recovery Technologies Inc. was established:

- to develop and manufacture energy-efficient cost-competitive, cryogenic whole tire recycling systems for sale on a turnkey basis in Canada and abroad; and

- to operate rubber tire recycling facilities, process scrap tires and related materials and selling recovered crumb rubber as well as producing new products using crumb rubber as a raw material.

PARTNERING INTERESTS

Recovery Technologies Inc. would be interested in talking to domestic and foreign manufacturers who have a need to process tires and other rubberized materials into new products.

In addition to an Italian project, Recovery Technologies is actively negotiating to supply cryogenic recycling systems on a turnkey basis to other prospective purchasers in the U.S.A. and Canada as well as in Europe and the Pacific Rim. The company expects to secure substantial orders for their Canadian designed and built equipment in 1992.

Recovery is also continuing to sell recovered rubber and other materials to both domestic and foreign purchasers. In addition, the company has an active program of research into the development of new products made from recovered rubber materials. These activities are additional revenue and technology generators for the company that supplement its equipment development and marketing operations.

CORPORATE HISTORY

Recovery Technologies Inc. is a Canadian-controlled Ontario corporation that was established in April 1989 with its head office in Mississauga. The company's primary physical asset is an existing experimental, industrial scale, cryogenic whole tire recycling facility and ancillary equipment that was purchased in late 1989. The experimental facility is located in a 10,000 sq. ft. plant on an industrial site in Ayr (near Cambridge) and is believed to be the only cryogenic whole tire recycling facility in North America.

Recovery Technologies is a member of the Group Venture Inc. consortium of Canadian industrial companies which has a combined staff of more than 2,000 persons and over 90,000 sq. ft. of manufacturing space.

- Revenue: Greater than $6 million
- Employees: 30
- Geographical markets: Canada, Europe, U.S.A., Asia, Mexico

TECHNOLOGICAL EXPERTISE

Recovery Technologies Inc. has diversified experience in the design, engineering, and manufacturing of turnkey production machinery and has supplied industrial equipment to many customers in Canada and abroad.

PRODUCTS DEVELOPED

Recovery Technologies Inc. has developed energy efficient, cost competitive, cryogenic whole tire recycling systems, for sale on a turnkey basis, whose output could be used for the production of new products and materials.

PRODUCTS IN DEVELOPMENT

Recovery Technologies has continued systematically researching and improving all aspects of the experimental facility in Ayr. Following the completion of many tire recycling trials, the company redesigned and rebuilt several of the operating components in the system. The effective separation yield has been increased significantly and the viability of the process has been proven on a full-scale basis.

Based on the demonstration of progress to date, Recovery Technologies secured an order in 1991 from Technologies Sistem Tyre S.r.l. of Veroli, Italy to produce a turnkey cryogenic tire recycling plant. This equipment has now been completed and will be shipped in mid-December.

SENTAR CONSULTANTS LTD.

10160 - 112th Street
Edmonton, Alberta
CANADA T5K 2L6

Telephone: (403) 428-0003
Facsimile: (403) 420-0622.

Key Personnel:
Kevin Metcalfe, Doug Hackbarth, Waste Management Group

Major Products/Services

- Waste Characterization Audits
- Environmental Audits
- Environmental Technology Assessments
- Alternative Waste Treatment Technology Evaluations
- Recycling/Resource Recovery Studies
- Planning and Design of Composting Systems and Facilities
- Incinerator Design and Contract Administration
- Waste Management Facility Siting and Design
- Landfill Operation Assessments
- Transfer Station Siting and Design
- Refuse Collection System Planning
- Development of Regional Waste Management Systems
- Value of Service Audits
- Bio-Medical Waste Disposal
- Waste Handling System Design
- Hazardous Waste Management
- Landfill Gas and Leachate Control
- Environmental Impact Assessments
- Air Quality Monitoring and Modelling

Partnering Interests

Local knowledge and representation are essential for any foreign work. Specifically, we would look for companies that have a good reputation and a large sphere of influence, as well as a need for our particular expertise.

Corporate History

SENTAR is a member of the Stanley Technology Group of companies which is Canadian-owned, headquartered in Alberta, and employs over 1,000 people in offices in Ottawa, Cambridge, Winnipeg, Saskatoon, Regina, Edmonton, Calgary, Surrey, and around the world. Since its formation in 1954 by Dr. D.R. Stanley, the Stanley Technology Group has provided planning, design and construction services to many levels of government and private industry. The diversification of our capabilities and competence of our staff has expanded and developed to the point where the firm is recognized and respected at the national and international levels.

- Revenue: $10 million per annum
- Employees:
  Sentar: 90
  Stanley Group: 1,200
- Geographical markets: Canada, Asia, Mexico, Caribbean, Middle East and China

Technological Expertise

Consulting engineering services provided, as well as bench scale and pilot scale testing of biological systems. Special expertise being developed in advanced combustion systems, integrated waste management planning, recycling, practical composting, and waste management in cold climates.

Products in Development

Examples of ongoing research and development activities and current process advances of solid waste management systems:

- Development of bioreactor technology
- Solvent extraction from soil technology
- Application of locally appropriate technologies to composting science
- Design of low-tech mechanical recyclers sorting process for single operations

GROUPE SERRENER INC.

360 Chemin St-Roch Nord
Rock Forest, Québec
CANADA J1N 2T3

Telephone: (819) 864-6877
Facsimile: (819) 864-7954

Key Personnel:
Jean Shairy, President

MAJOR PRODUCTS/SERVICES

- Recycling for municipol, commercial and industrial sectors
- Sanitary landfill permitting and management
- Leachate and biogas management
- Structural soil membranes
- Sludge dewatering and treatment
- Composting technologies for organics recovery and re-use
- Site assessment, remediation technologies and special purpose equipment to support the environmental services

PARTNERING INTERESTS

Establish joint-venture company in northeast U.S.A. for treatment technologies and environmental services.

Distribution
- Contracting companies interested to sub-licence/distribute DAB, dewatering system in U.S.A. and western Canada.
- Developing relationships to enter U.S. market with MEDIAFLEX filter system, SITTLER compost turner and composting technologies.

Technology Transfer
- Developing contacts for new technologies for solid waste management.
- Interested in R&D project which may result in technology transfer.

Financing
- Interested in financial partners for new projects/technologies development.

Agreements
- North American licence for DAB dewatering system

CORPORATE HISTORY

Incorporated in 1988, Groupe Serrener Inc. with three offices plus laboratory in Québec, works solely in the waste management business. The corporate structure includes consulting (Serrener Consultation Inc.), operations-systems-equipment (Valoraction Inc.), organic and inorganic laboratory with R&D capabilities (Crealab Inc.), and complete turnkey management of residuals (Courtages Alenag Inc.).

- Revenue: Greater than $7.5 million
- R&D Expenditure: $200,000 to $600,000
- Employees: 61
  Research and development: 11
  Marketing: 12
- Geographical markets: Canada, Europe, U.S.A., Asia, Mexico, French-speaking African countries.

TECHNOLOGICAL EXPERTISE

- Composting organic wastes for beneficial reuse
- Water and biosolids treatment
- Structural soil membranes
- Solid waste elimination landfills
- Bioremediation for hazardous waste cleanup
- Granulation process for animal, mineral and organic wastes
- Laboratory sampling/analysis processes

PRODUCTS DEVELOPED

- Solid waste elimination landfills
- *In-situ* soil treatment
- Organic waste composting using windrow, aerated static pile and combination systems for inputs such as sludges, yard, food and animal wastes
- Chemical stabilization of solid wastes
- Markets compost turners, operating services and systems
- Designs and instructs compost platforms
- Biosolids treatment

PRODUCTS IN DEVELOPMENT

- Composting technology – in-vessel compost systems
- Sludge dewatering and leachate treatment
- Production of balanced biological fertilizers from compost
- Organic odour reduction from compost
- In-situ remediation of contaminates in soils

UMATAC INDUSTRIAL PROCESSES

210 - 2880 Glenmore Trail S.E.
Calgary, Alberta
CANADA T2C 2E7

Telephone: (403) 279-8080
Facsimile: (403) 236-0595

Key Personnel:
R.M. Ritcey

MAJOR PRODUCTS/SERVICES

UMATAC Industrial Processes (UMATAC) of Calgary developed the AOSTRA Taciuk Process (ATP) technology which is a unique, thermal desorption system for separating and extracting water and organics from host solids. It is particularly suited for use in treating contaminated soils and sludges in environmental remediation work.

UMATAC has also applied the ATP System to treatment of hydrocarbon-bearing wastes, such as oily soils and sludges. Typical applications are:

- Cleaning and recovering oil from oil wastes produced in oil field production and operations of oil refineries and petrochemical plants.
- Clean up of soils or other materials which are contaminated with PCBs or other heavy organic compounds, such as coal tars and industrial chemicals.

Organics and water are separated by anaerobic thermal desorption as vapours which are condensed to liquids in a second step of the system. The oil fraction is potentially recyclable, depending on the type of contaminant.

The ATP has been used commercially on soils remediation in the United States since 1990. A 10 tph capacity plant has successfully completed PCB clean up of two Superfund sites, and is beginning work on two others in 1993.

The AOSTRA Taciuk Process (ATP) - UMATAC is the developer and supplier of the unique ATP technology. The TP is a patented pyrolysis process which remediates solid and liquid wastes by continuous flow thermal desorption.

UMATAC supplies the technology under licence to user operators in the environmental field of waste treatment and remediation. It also supplies the ATP plant equipment to the user licensee.

PARTNERING INTERESTS

UMATAC supplies the ATP technology under license for use in waste treatment and also manufactures and supplies the ATP plant equipment.

UMATAC seeks companies or organizations as new licensees and users of the unique ATP technology.

CORPORATE HISTORY

- UMATAC is a division of UMA Engineering Ltd., a Canadian engineering services company
- UMATAC was formed in 1976
- Revenue: Greater than $2 million
- R&D expenditure: $1 million
- Employees: 25–50
  Research and development: 15
  Marketing: 1
- Geographical markets: U.S.A., Canada, South East Asia, Europe

TECHNOLOGICAL EXPERTISE

UMATAC has unique expertise in thermal pyrolysis with continuous flow, multi-chambered, rotating vessels.

Additional expertise includes the use of the ATP technology to process candidate feedstocks, ranging from oil resource materials (oil sand, oil shale) to organically contaminated soils and wastes.

Products Developed

The AOSTRA Taciuk Processor and operating plant. Processors can be supplied in sizes ranging to 1,000 tph feed capacity each, and in multiples for large plant capacities.

Products in Development

New features of the ATP Processor to provide more versatility of use.

UTOPIA MANUFACTURING LTD.

R.R. #1
Pennfield, New Brunswick
CANADA E0G 2R0

Telephone: (506) 755-6168
Facsimile: (506) 755-3784

Key Personnel:
Ken Bourque, Marketing Manager

Major Products/Services

Manufactures and markets the Shurtleff Used Oil Refining System. This patented process takes used lubricating and crankcase oils and refines them into #2 and #3 diesel fuel substitutes. Each modular, skid mounted processing unit can refine 1.5 million gallons of used oil per year. It is a low temperature thermal cracking process whereby the inherent metals contained in the used oil act as a catalyst. Potential environmentally unfriendly metals and sulphur are removed as inert, non-leachable waste residue solid.

Partnering Interests

Utopia is currently marketing the process and has seven plants operating in North America and Asia. The company is interested in developing alliances with strategic partners in countries around the world to jointly develop used oil collection and processing businesses.

Corporate History

The process was invented by Mr. Edward Shurtleff, President of Utopia Fabricating Ltd. In 1987, he started manufacturing and selling processing units. Today, there are four plants operating in Canada, two in the U.S.A. and one in South Korea. More than 40 processing units are on order for delivery this year.

- Revenue: Greater than $5 million
- R&D expenditure: $200,000 to $500,000
- Employees: 45
  Research and development: 3
  Marketing: 2
- Geographical markets: Canada, Europe, U.S.A., Asia, Mexico

Technological Expertise

Used oil is a problematic waste which is facing strict new regulations around the world. In North America, currently 60% is being collected, but the majority is disposed of in environmentally unfriendly ways. Although regulations are restricting historical disposal methods, there are few alternatives for effectively reprocessing it and removing the hazardous contaminants. The patented Shurtleff process is a low cost alternative to refining used oil. It is a low temperature thermal cracking process which generates an oil product similar to #2 and #3 diesel fuel which is used as fuel for on and off road commercial diesel engines. All of the trace metals in the used oil are concentrated in an inert, non-leachable ashcake. Testing indicates high concentrations of lead and zinc. The ashcake does not represent any enviornmental handling problems.

Processing units come in three sizes: 250 GPH (gallons per hour), 120 GPH and 80 GPH.

- The technology is patented worldwide
- The applied technology is a scaled system thermal cracking process which uses the inherent metals as a catalyst
- The product is upgraded (value added) to be sold as a diesel engine fuel substitute
- The process is not capital intensive
- The process is easy to operate with a low labour content
- The process is environmentally friendly
- Hazardous metals are 100% contained in a non-leachable ashcake
- Sulphur is reduced to less than .2%
- There are no special or hazardous waste products generated
- The plants are energy self-sufficient
- Finished products have excellent performance characteristics
- Economics are very good, even for a small-scale application

Products Developed

Shurtleff Used Oil Refining process.

Products in Development

Utopia is currently working on a number of activities to complement and improve its equipment:

- Flash Point Adjustment
- Used Oil Dehydration
- Desulphurization
- Cooling light ends into a reusable product

The company is also looking at using the process for other waste materials including:

- Distilling anti-freeze
- Tires
- Plastics

WATER AND EARTH SCIENCE ASSOCIATES LTD.

Box 430
Carp, Ontario
CANADA K0A 1L0

Telephone: (613) 839-3053
Facsimile: (613) 839-5376.

Key Personnel:
Derek Smith, President
John Reid, Manager, (International Operations)

MAJOR PRODUCTS/SERVICES

The principle fields of activity of WESA are in:

Municipal and Industrial Waste Disposal Sites

- Solid waste management
- Waste audits
- Landfill investigations
- Site design and operations plans
- Remedial landfill engineering
- Monitoring and rehabilitation
- Environmental impact assessments

Hydrogeology/Contaminant Hydrogeology

- Environmental investigations and audits
- Industrial site decommissioning
- Soil and groundwater rehabilitation
- Computer modelling of contaminant transport and groundwater flow
- Surface and groundwater hydro-geochemistry
- Fluvial hydrogeology and sedimentology
- Terrain analysis and geological mapping
- Municipal water supply
- Water treatment

PARTNERING INTERESTS

Water and Earth Science Associates believes that associations/partnerships with local companies are essential to provide cost-effective and appropriate solutions. WESA would like to associate with engineering and consulting firms that require the specialized environmental expertise that the company can offer. WESA would also like to develop contacts and provide services for private manufacturing industries, waste disposal firms, local, regional, national governments and insurance/banking/real estate institutions involved in land transfers.

CORPORATE HISTORY

Water and Earth Science Associates Ltd. (WESA) has been in business for 18 years and specializes in solid waste management projects, industrial site remediation work, environmental assessments and waste audits, contaminant hydrogeology, industrial site decommissioning and groundwater supply.

WESA has a professional staff of over 50 hydrogeologists, auditors and support staff. The head office is situated in Carp/Ottawa, Ontario with branch offices in Kitchener, Ontario and Hull, Quebec. WESA also opened a new office in London (U.K.) in 1992. The company is presently working in Canada, Britain, Africa and is carrying out environmental impact assessments for the World Bank in various countries. WESA is a Canadian privately owned company totally independent of any contracting or supply organization.

- Revenue: Greater than $5 million
- R&D expenditure: $250,000 to $500,000
- Employees: 50
- Geographical markets: Canada, Europe, Mexico, Caribbean, Asia, Africa

Technological Expertise

In Canada WESA provides engineering design and operations support and carries out the monitoring programs at several sites for Laidlaw Waste Systems Ltd., the largest waste management corporation in Canada. The landfills in which the company is involved have annual tonnages ranging from 60,000 to 400,000 tonnes per year. WESA has also completed solid waste management plans, and landfill design and operations plans for more than 16 municipalities and many industries. Innovative technical advances in leachate containment and treatment have been developed, tested and implemented, such as constructed wetlands treatment systems.

Internationally, WESA has several experts presently working in Britain, where the company is carrying out industrial site de-commissioning projects for Northern Telecom, one of the largest telecommunications firms in North America. Work in Africa includes a sanitation study in Dar es Salaam (Tanzania), as well as the development of the water supply in Dodoma (Tanzania), the new capital, and the company is carrying out environmental impact assessments for the World Bank in various countries. WESA is registered with the World Bank, the Asian Development Bank, the Inter-American Development Bank, the African Development Bank and the Caribbean Development Bank.

Products Developed

WESA can offer the following types of consulting services to the solid waste management industry.

- Hydrogeological civil and environmental engineering expertise related to municipal and industrial waste disposal sites, including landfill investigations, site design and operations plans, leachate collection and treatment, geosynthetic liner design and installation, remedial landfill engineering, monitoring and rehabilitation and environmental impact assessments.
- Computer modelling of groundwater flow, stormwater drainage and landfill volumetric scenarios.
- Well design, well drilling, chemical and physical testing of all types. Field equipment includes a field gas chromatograph, photo-ionization detectors and a wide variety of pumps and testing equipment.
- Total station topographic surveying and Auto-CAD expertise.

Products in Development

On-going project-specific R&D activities include:

- Constructed wetlands leachate treatment systems
- Constructed wetlands volatile organic compound (VOC) treatment systems
- Enhanced land farming treatment techniques using food processing waste
- PCB degradation *in-situ/ex-situ* using surfactants, co-solvents and biological activity

JACQUES WHITFORD ENVIRONMENT LIMITED

711 Woodstock Road, P.O. Box 1116
Fredericton, New Brunswick
CANADA E3B 5C2

Telephone: (506) 457-3200
Facsimile: (506) 452-7652

Key Personnel:
Jacques Poynter, Manager

MAJOR PRODUCTS/SERVICES

Jacques Whitford Environment Limited (JWEL) is part of the employee-owned Jacques Whitford Group of companies, which offers clients a network of over 340 consulting engineers, scientists, and environmental planners in 15 offices in Atlantic Canada, Québec, Ontario, Alberta and the United States. JWEL is able to provide a high level of expertise in all aspects of waste management. Given the diversity of skills throughout JWEL, the firm is able to provide a full range of solid waste management services including:

- waste audits
- assessment of waste management alternatives
- solid waste facility site selection studies
- public consultation
- environmental impact assessment
- landfill design
- transportation and collection system assessment
- construction supervision
- abandonment and closure

JWEL is currently involved with the development of waste management strategies for both government and industry. These strategies involve a high degree of public concern, thus public consultation and involvement is an important aspect of the overall strategy development. JWEL routinely uses computer modelling, such as geographic information systems, hydrogeological modelling and transportation systems modelling, in several aspects of solid waste management planning.

PARTNERING INTERESTS

JWEL seeks strategic alliances with industry, universities and government, regardless of location.

CORPORATE HISTORY

- Revenue: Greater than $30 million
- R&D expenditure: $200,000 to $500,000
- Employees: 350
  Research and development: 3
  Marketing: 5
- Geographical markets: Canada, U.S.A., Russia, Asia, Africa, South America, Mexico, Caribbean

The Jacques Whitford Group of companies is a Canadian owned engineering and environmental consulting firm incorporated in 1972. Originally specializing in geotechnical services, the firm now offers services in five major disciplines:

- geotechnical engineering
- materials testing and research
- mining
- environmental sciences and planning
- environmental engineering

The environmental division was established in 1985 and is now known as Jacques Whitford Environment Limited.

Technological Expertise

JWEL provides a full range of waste management planning services, and thus can provide "one-stop shopping" in this field. JWEL can bring a government or industrial client through all of the stages necessary for an overall waste management plan including determining the current waste generation, identifying waste minimization strategies, identifying waste management and disposal options, selecting waste facility sites and design and construction of landfills. This wide range of abilities allows JWEL to provide a consistent and efficient planning process.

Products Developed

JWEL has applied computer models to several areas of waste management planning. JWEL uses geographic information systems (SPANS, CARIS) extensively in the site selection process. The use of GIS allows several site selection criteria to be evaluated simultaneously. In addition, it allows for several "what if" scenarios to be considered relatively easily and quickly. JWEL has used the GIS interactively with the public to develop site selection criteria. The GIS is used to immediately show the effect of changing specific site selection criteria.

Products in Development

JWEL continues to enhance the previously developed GIS models through integration with other hydrogeological, hydrological and transportation models, as well as development of various decision support systems based on GIS.

♻ Printed in Canada 1993