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R-NET

Canadian Association of Recycling Industries

RECYCLING TECHNOLOGY NEWSLETTER

VOLUME 9, ISSUE 1, SEPTEMBER 2005

Although recycling is a crucial component in our fight for a sustainable civilization, society's current perceptions are that:

- Recycling is a relatively new activity.
- Recycling has some positive environmental aspects.
- Recycling is a component of the waste management sector.
- Products made with recycled materials are inferior in quality from those made with virgin materials.
- Participation in collections programs, such the Blue-Box, is recycling.

In our society, waste and anything associated with waste carries a stigma. We waste opportunities; we waste time; we waste money; we waste an education; and we even waste our minds. Waste is certainly not something that is considered useful and, in the final analysis, not something with which we want to be or should be associated. The natural consequence of this attitude is that many, if not the majority of consumers, believe that a product with recycled content is inferior in quality to a product made of virgin materials, and they therefore do not seek out and create demand for recycled materials. This is the major issue with plastics today - lack of markets.

To date, society's perceptions and attitudes have led to recycling programs that are part of the waste industry. Theses programs have failed to maximize the benefits of real recycling. Governments squeeze recycling into by-laws, regulations, and legislation that are developed for and applied to waste management. This increases the administration and operating costs for recyclers without any benefit to the environment. To achieve the maximum benefits from recycling, society (especially government) must adjust its attitudes remembering above all that:

- Recyclable materials are not wastes.
- Recycling is a truly sustainable development industry.
- Recycling is an environmental solution.
- Recycling creates jobs.
- There should be a national recycling policy.

The demand for recycled products can be increased through green procurement policies, education, and product information, and not solely through the collection of recyclable materials. Government legislation and regulations must be simple, must distinguish recyclables from waste, must prevent overlap in jurisdictions, and must be supportive of free trade.

Leonard Shaw
Executive Director
Canadian Association of Recycling Industries

VISIT R-NET's HOME in cyberspace at **http://RNET.NRCan.gc.ca/** This bilingual web site contains current and previous issues. Bookmark this site and visit it often for interesting links and current event listings.

Please keep writing to us with your ideas and suggestions. Share your success stories with us, do not forget to tell us about meetings and conferences that you are organizing, and be sure to let us know if you mention us in any of your publications.

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Enhanced Recycling

The United Nations Framework Convention on Climate Change (UNFCCC), a product of the Earth Summit held in 1992 in Brazil, aims to stabilize greenhouse gas (GHG) emissions "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system." The Kyoto Protocol, established in 1997, is a mechanism to achieve this aim. The Protocol came into effect on February 16, 2005, after Russia's ratification in November 2004. According to Environment Canada's Greenhouse Gas Division, Canada's projected annual GHG emissions by 2010 (the Kyoto Protocol commitment period) would be 809 Mt CO_2e, in the absence of any efforts to reduce emissions (i.e., the business as usual projection). By ratifying the Kyoto Protocol, Canada has committed to reduce these emissions to 572 Mt CO_2e by 2008-2012, (6% below 1990 levels and 29% below projected 2010 levels). On April 13, 2005, Canada released "Moving Forward on Climate Change: A Plan for Honouring our Kyoto Commitment". One can access it at http://www.climatechange.gc.ca

A climate change mitigation effort already in place, the *Government of Canada Action Plan 2000 on Climate Change* Minerals and Metals Program, is working towards reducing Canada's GHG emissions from the minerals and metals sector through initiatives supported by matching funds with other partners. The *Enhanced Recycling* program, initiated in April 2001, is a 5-year program and an element of the Minerals and Metals Program. So far, *Enhanced Recycling* has supported close to 40 projects aimed at increasing the knowledge of the types and quantities of end-of-life resources available in different regions and sectors of Canada, and identifying and enabling new opportunities for recovering these resources and putting them back to work in our economy.

Adding Residential Scrap Metal to Municipal Curbside Recycling Programs

The Ottawa Valley Waste Recovery Centre (OVWRC) near Pembroke, Ontario serves the waste management needs of a population of nearly 40,000 in nearby municipalities with bi-weekly collection of garbage, paper, mixed recyclables and organics. Their state of the art operation includes a Material Recovery Facility, a Centralized Composting Facility, an Outdoor Composting Area, a Construction and Demolition Waste Recycling area, a permanent Household Hazardous Waste Depot, a waste oil transfer station and a Landfill.

Residents place their commingled recyclables at the curbside in a 25-gallon 'Triple R Can'. The list of recyclables accepted is extensive: empty paint cans, empty aerosol cans, glass bottles and jars, plastic bags, milk and juice cartons including drink boxes, plastic containers (#1 through #7), steel and aluminum cans and foil and **small scrap metal items**. Paper must be placed in a separate reusable container.

Organics are collected in a 'green cart'. After organics are sorted (non-organics removed) and shredded, they are mixed with wood chips, which act as a bulking agent and provide the desired carbon to nitrogen ratio, moisture content, structure, particle size and pH. From here, the mixture is sent to one of the 11 site CompTainers™, where they are exposed to warm circulated air for up to 21 days. The resulting material then spends up to three to four months curing at the outdoor composting area. Finally, after screening, the rich soil amendment is ready for sale. OVWRC sells their compost for $15 per cubic yard (470 kg) and has sold out three years in a row since starting operations.

Scrap metal collection has been added to OVWRC's service area as a result of the successful outcome of a pilot project to determine the feasibility of collecting items such as baking sheets, pots and pans, irons (cords removed), coat hangers, plumbing fixtures, hinges, wire, tools and cutlery, galvanized steel and copper pipes with other recyclables in the Triple-R-Can. With support from *Enhanced Recycling*, the pilot project called "Don't Scrap It!" ran from April to November 2004, with almost 4,000 households participating. The pilot, and the now permanent collection for the entire service area, did not include large scrap metal items such as chairs, fridges/stoves, BBQs, bicycles, propane tanks, and large car parts. It also did not include really small items such as nuts, bolts, screws or nails because they are too small to process.

Waste audits performed before the pilot project, in November 2003, showed that the diversion of metal and metal-bearing materials before the implementation of "Don't Scrap It!" was close to 40%, with 200 to 250 tonnes (t) of metal and metal-bearing material being annually landfilled.

The "Don't Scrap It!" project realized a diversion of 4.85 kg/household over the pilot area through the nine months of the pilot, translating to a diversion rate of 6.06 kg/hh/year (approximately 24 t annually) from the nearly 4,000 households. Based on the results of the pilot study, giving the access to "Don't Scrap It!" to all of the households in the OVWRC service area (~17,000 households) should result in the diversion of a total of 103 t/yr of scrap metal from landfill increasing the diversion from 40% to almost 70%. Throughout the pilot project, the OVWRC received about $45/t from the sale of their scrap metal items to various end-market recyclers.

"The addition of scrap metal to the recycling program is beneficial in two ways. First, we are keeping that material out of landfill, conserving valuable landfill space and second that material is a revenue source for the Centre." says Joseph Hall, General Manager. "It also allows residents a convenient method of disposing of household items such as an old frying pan or metal piping from your plumbing project."

The OVWRC recently won national recognition for their efforts; the 2005 FCM-CH2M Hill Sustainable Community Award in the category of Solid Waste. Since 2000, the FCM-CH2M HILL Sustainable Community Awards have recognized innovation and leadership in municipal services that contribute to a sustainable future. The OVWRC's website (www.ovwrc.com) provides access to an up close and personal account of what happens to the recyclables and organics – with great photos.

Twentieth Century Copper Stocks and Flows in North America: A Dynamic Analysis

S. Spatari, M. Bertram, R.B. Gordon, K. Henderson, T.E. Graedel

Ecological Economics ***2005****, 54, 37-51*

The twentieth century accounted for approximately 90% of all copper mined and put into service throughout the last five thousand years: 70% of it in only the last 50 years and 50% in only the last 25. The authors have quantified the complete life cycle flows of copper extracted and used during the twentieth century in North America estimating the accumulation of copper-bearing products in use and in waste reservoirs (including landfills and tailing ponds) in North America over the period 1900–1999. They devised and applied a novel residence time model to predict copper amounts found in the waste system. This model contains four main components or life stages: production, fabrication and manufacturing, use, and waste management. It demonstrates a significant rise in landfilling of copper derived from post-consumer waste between 1940 (270 kilo tonnes Cu/year) and 1999 (2790 kilo tonnes Cu/year). Unfortunately, this trend may intensify with the increasing rate of electronic equipment use, shorter residence times, and the absence of an efficient collection and processing infrastructure for retired electronics.

In their investigations, the authors use a variety of sources such as, World Bureau of Metal Statistics, International Copper Study Group, U.S Geological Survey, U.S. Bureau of Mines and the United Nations' statistics. They also build on earlier work reported by one of the authors - R.B. Gordon (**Production Residues in Copper Technological Cycles**, published in *Resources, Conservation and Recycling* ***2002****, 36(2), 87-106*). According to the authors, the copper cycle shows a relatively high recycling rate

(40%) for post-consumer waste, but a large amount is stored in landfills (60%). Unless the stored copper can be economically extracted, this resource is lost to society. An important part of ensuring the feasibility of secondary (post-consumer) recovery and reuse, is to collect and store waste materials in such a way that they may be located and recovered at minimal cost, thereby improving the future secondary material recovery infrastructure.

Through the MACROSCOPE: the Legacy of H.T. Odum

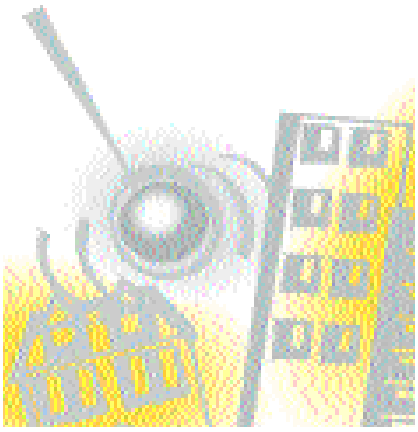
Edited by M.T. Brown and C.A.S. Hall

Ecological Modelling ***2004****, 178(1-2), 1-292*

This issue of *Ecological Modelling* contains 50 articles on the legacy of Howard T. Odum. Odum was a system ecologist, a scientist unifying the fields of ecology, ecological engineering, energy analysis, systems science, and ecological economics considering humans as a legitimate object of ecological inquiry. In the Preface to **Environment, Power and Society** (*John Wiley & Sons, Inc.,* ***1971***) Howard T. Odum writes: "When systems are considered in energy terms, some of the bewildering complexity of our world disappears; situations of many types and sizes turn out to be special cases of relatively few basic types." For Odum it was vital to understand how systems change, grow, die, react to pulses, or accommodate new conditions. From the early 1950s, Odum envisioned a partnership of humanity and nature. Ecological engineering arose from his awareness that nature has had no wastes, that natural ecosystems recycle everything. He understood the role of humanity as serving the ecosystem in exchange for life support as natural environments are an essential part of man's total environment.

Historically, questions related to environmental policy have been difficult to solve, because solutions depend on accurately balancing the needs of both human and natural systems. The account for environmental systems cannot be kept in dollars

Let's Climb Another Molehill – An Examination of Construction, Renovation and Demolition Waste Diversion in Canada & Associated Greenhouse Gas Emissions



The Recycling Council of Ontario (RCO) (www.rco.on.ca) and RENOVA Consultants have completed 15 case studies of a range of construction, renovation and demolition (CRD) projects in the Greater Toronto area. Their aim was to work closely with those involved on each CRD site (including designers, architects, project managers, site managers, environmental managers, waste haulers and recyclers) to develop Waste Management Action Plans (WMAPs), to examine the types of materials generated by CRD activities, the recycling/reuse options that were available for these materials and the associated costs and environmental benefits of recycling/reuse.

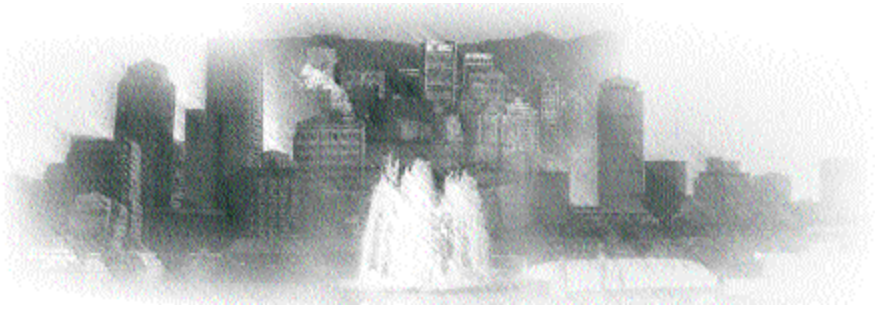
The development of WMAPs at the outset of a project requires those involved on a site to predict what kinds of materials their activities will generate. The next step is to identify what regular "waste" management practices could be changed to first prevent and then divert CRD materials from disposal, and to identify the roles and responsibilities of all parties involved.

The majority of "wastes" from the case studies came from renovation and demolition activities, with the four most predominant materials being concrete, steel, wood and gyproc. Overall, a total of 221,854 tonnes of materials (majority of which was concrete) were diverted from disposal from 12 case studies.

The Athena Sustainable Materials Institute – a non-profit organization that has developed various tools for promoting the sustainability of the construction environment – was also involved in the project. Athena was to determine the impact on greenhouse gas emissions of the increased waste diversion resulting from the case studies. Athena used their Environmental Impact Software to estimate that the recycling and reuse of materials promoted in the "Molehill" case studies resulted in savings of more than 1,000 tonnes of CO_2e – GHG emissions to the atmosphere that would have occurred, through the manufacture, transport and use of new materials in the place of recovered materials.

While the savings of 1,000 t of CO_2e may seem like only a drop in the bucket, it is important to remember that this represents the outcome of efforts on only 15 CRD projects. Imagine the savings that could be possible if the 3Rs were an integral part of every CRD project. When dividing the total volume of materials diverted from disposal through the case studies (221,854 tonnes) by the total GHG savings calculated, Athena's work showed that an average of 4.8 kg of CO_2e was saved per tonne of CRD material recycled. Athena's website offers a free downloadable trial version of this software (www.athenaSMI.ca).

For more information about this project, please contact Jo-Anne St. Godard, Executive Director of the Recycling Council of Ontario, at (416) 657 – 2797, extension 1.



GUIDE FOR SUSTAINABLE COMMUNITIES

By the Federation of Canadian Municipalities

Canada may have a solid reputation when it comes to waste management, but a close look at the facts shows that more must be done if we are to become a country with practices that are truly sustainable. This means generating less waste and using discarded materials in the manufacturing of new products.

In the late 1980s, Canadian federal, provincial and municipal governments agreed to a target of 50% reduction in waste by 2000. While some communities have reached this goal, the average waste diversion reached a plateau of less than 24%; meaning that more than 75% of Canada's waste embodied energy and material stock is lost. At the same time the total waste generation in Canada grew by 12% (1998-2000). In 2000, municipal governments spent approximately $1.5 billion on solid waste management; only $97 million in revenues was received from the sale of recyclables.

The 20th Century saw the establishment of a "new is better than used" culture, resulting in "recycled is second-hand and therefore inferior." This culture is gradually being replaced with an environmental ethic, but change is slow.

The benefits of reducing waste and recovering materials are not fully appreciated by the general public. Unfortunately, the term "waste" is associated with low value, unwanted material and contradicts the concept that discarded materials from one system could be a resource for another. The one thousand municipal government members of the Federation of Canadian Municipalities (FCM) have agreed that current management of municipal solid waste reflects inefficient resource utilization and that waste needs to be viewed and managed as a resource for the "new materials management economy" that supports sustainable development.

The following material introduces some of the ideas integral to FCM's approach.

A Community-based Approach to Setting Goals

The community-based decision-making process has been used extensively in Canadian municipalities working on integrated resource and waste management strategies. Ensuring a successful community based decision-making process requires:

- Inviting community participation in the process through committee(s) comprising different stakeholder groups (such as environmental non-profit organizations, affected neigh-

alone, because environmental systems are based not only on the work of the paid workforce but also on the work of ecosystems, for which no money is paid. An accurate picture of environmental systems requires accounting for the flow and storages of energy, matter, and information that are responsible for supporting economic and social activities and that may not be accompanied by flows of money. In the 1980s, H.T. Odum developed the concepts of emergy. Emergy is the available energy of one kind previously used up directly or indirectly to make a product or service, and so signifies the past use of energy that is embodied in the present product or service. The unit of emergy is emjoule. The emdollar (Em$) value of a flow or storage is its emergy divided by the emergy to money ratio for the economy in that year. Emdollars indicate the money circulation whose buying power is supplied by the use of a quantity of emergy.

Odum's innovation established a medium for environmental accounting that, for the first time, made it possible to express economic commodities, services, and environmental work of all kinds on a common basis as emergy. Converting flows of energy to emergy puts the work done by the economy and the environment on the same scale, making the economic and environmental flows directly comparable.

Howard T. Odum was convinced that he was living through a moment of history when fuel, the product of some ancient ecosystems, was cheap. He always thought that if a full, comprehensive analysis was made of all necessary inputs then there would be few, if any other energy sources that could match petroleum. He did not know exactly when we will "run out of cheap oil" but he expected it to be within a generation and maybe much sooner. In his works, he warned that the unwise use of the stores of resources would have serious consequences on the subsequent standard of living.

Analysing the Evolution of Industrial Ecosystems: Concepts and Application
J. Korhonen and J-P. Snäkin
Ecological Economics ***2005****, 52(2), 169-186*
Industrial ecology (IE) and the industrial ecosystem approach are emerging concepts in ecological economics, environmental policy and corporate environmental management. The natural ecosystem model of diverse recycling and cascading material and energy flow systems are being used to address the problem of industrial society's linear material and energy flows where resources are used up and wastes and emissions pile up.

Industrial ecology aspires to introduce a new paradigm where waste utilisation between manufacturing systems reminds us of the carbon–oxygen cycle in nature: plants use carbon dioxide producing oxygen as a waste and animals need the oxygen to survive thereby generating carbon dioxide as a waste. In nature, plants are producers, animals are consumers and bacteria and fungi are the decomposers or recyclers of the natural world, all of which are studied in IE to find similar structures in industrial ecosystems.

The authors examined the evolution of the Uimaharju industry park in the small municipality of Eno in Eastern Finland. The site has grown from a sawmill site in 1955 to a diverse industrial park that in the authors' words utilizes considerable amounts of renewable energy sources in its industrial production process as well as employs energy cascades and achieves raw materials recovery and recycling. At present there are six industrial entities in this industrial park: a sawmill, pulp mill, waste ash treatment plant, heat and power plant, industrial gas plant and a wastewater treatment plant. There is also a landfill. The authors suggest that the compilation of research methods that they have amassed in this publication could be a useful tool in examining industrial ecosystems and eco-industrial parks.

bourhoods, businesses, service clubs, and social organizations) with a direct interest in the issue and different views about solutions;
- Providing background readings and information sessions for committee members and the public, allowing them to become familiar with the issues and terminology and to make informed decisions;
- Providing a variety of venues (e.g., workshops, forums, town hall meetings) where the public can express views and participate in the decision process;
- Using facilitators with strong mediation skills to maximize co-operation and consensus building during meetings;
- Having committee members commit to attending public forums and workshops to express support for the process and resolution(s);
- Identifying and developing specific issues that can be resolved through public consultations and input; and
- Communicating the options and resolution(s) to constituents throughout the process.

Policy and Regulatory Considerations
Policies and regulations, coupled with technologies, form the cornerstone of an integrated resource and waste management system. Direct and indirect ways municipal governments can influence citizen and industry behaviour, include:
- Bag limits and user pay;
- Development of reuse centres;
- Development of eco-industrial parks;
- Landfill bans on specific materials, such as old corrugated cardboard (OCC), tires, and yard waste;
- Extended producer responsibility programs at the local level;
- Specific policies targeting industrial commercial and institutional (IC&I) waste;
- Green procurement protocols (e.g., "buy recycled" purchasing requirements);
- Full life-cycle cost disposal charges;
- Centralized composting;
- Higher tipping fees; and
- Curbside recycling.

Green Procurement
Federal, provincial/territorial, and municipal governments purchase billions of dollars worth of goods and services each year. Governments have realized that their purchases can have a significant effect on the environment and have developed policies or guidelines to incorporate environmental considerations into their purchases. Environmental attributes of products to be considered may include:
- Energy efficiency;
- Recycled content and recyclability;
- Water efficiency;
- Resource conservation;
- GHG emissions;
- Waste prevention;
- Renewable material percentages;
- Adverse effects on workers, animals, plants;
- Toxic material content;
- Excess packaging;
- Transportation distances;

- Reparability; and
- Industry/supplier take-back of waste/end-of-life products.

Green procurement is seen by many as a crucial step toward sustainable development, reducing environmental effects and encouraging the use of products less harmful to the environment.

Some environmental benefits of green procurement include:
- More efficient use of resources;
- Less energy used;
- Reduced air and water pollution;
- Less waste disposed of and the development of markets for recycled materials;
- A reduction in the use of toxic or hazardous products; and
- Longer landfill life (because of more diversion to recycling).

PROCESSING OF RECYCLABLES

From a municipality's point of view, recycling refers to the recovery of dry materials, such as paper, plastics, glass, and metals from the waste stream to be sold to recycling companies for incorporation into new uses. Which material a municipality chooses to collect depends on several factors, including cost, existence of a market, distance to a market, and public acceptability. Currently, recycling is only applicable to 30% to 40% of the waste stream. However, in theory, if all viable materials in the waste stream were captured, recycled and composted, approximately 70% to 80% of the waste stream could be diverted from landfill.

The recyclable materials collected by municipalities must be separated and processed before they can be sent to various recycling facilities. This section describes the equipment used by municipalities to achieve this undertaking.

Bag Breakers/Openers

There is much variety in the market, but most implements designed to open plastic bags containing end-of-life materials can be categorized as either slitters or augers. There is no mechanical "debagger" that does an efficient job of breaking the bags and mechanically collecting the plastic. All units require some degree of downstream manual separation of the plastic film. Auger-type bag openers rely on a screw (auger) rotating in a cylinder. As bags are moved through, they are ripped by the action of the auger against the inside cylinder wall. This breaker is popular for use with bagged organics (e.g., as in the City of Guelph, Ontario, wet composting plant).

Air Classifiers for Light/Heavy Sort

Low velocity air is used to separate lighter materials (e.g., aluminum and plastics) from heavier materials (glass) once on the conveyer belt at the material recovery facility (MRF). This can be accomplished by:
- Blowing the lighter materials across an air knife to another conveyor at a conveyor tail pulley (heavier materials drop over the tail pulley).
- Using suction above a commingled container stream on a conveyor to remove the lighter material (heavier material stays on the conveyor). Once removed, the lighter materials are directed to a separate sorting conveyor.

The Prosperous Way Down
H.T. Odum and E.C. Odum
*Energy **2006**, 31(1), 21-32*
Available online July 14, 2004.
Human societies grow and decline. There are many examples of once-proud and enormous civilizations, where nothing now remains but ruins (Roman Empire), pyramids in the desert (Ancient Egypt) or mysterious stone figures (Easter Island).

In this article, the authors predict a serious economic downturn in the near future as the highest quality and hence cheapest fossil fuels are depleted. This episode can happen in one of three ways: as a crash, as a slow uncontrolled decay over several decades, or as an organized transition process over many years leading to a "prosperous way down."

The authors start with the assumption that resource scarcity and rising costs will cause the global economy to contract. Many people assume that the only way down is to crash and restart. But many systems program orderly descent and decession (the opposite to succession) that is later again followed by growth and succession.

The authors describe their findings using the pulsing paradigm: the emergy theory and the maximum empower principle, rooted in the General System Theory and the laws of thermodynamics. The authors recognize four main stages of the pulsing cycle: (1) Growth on abundant available resources, with sharp increases in a system's population, structure, and assets, based on low-efficiency and high-competition; (2) Climax and transition, when the system reaches the maximum size allowed by the available resources, increases efficiency, develops collaborative competition patterns, and prepares for descent by storing information; (3) Descent, with adaptations to less resources available, a decrease in population and assets, an increase in recycling patterns, and a transmission of information in a way that minimizes losses; (4) Low-energy restoration, with no-growth,

consumption smaller than accumulation, and storage of resources for a new cycle ahead.

The tremendous concentration of economic enterprises and people in cities is based on cheap fossil fuels. Reintegrating cities with their region of support and influence may help solve severe urban problems while preparing those cities for the decentralization expected in the time of descent. The decentralized cities will have less-intensive fuel consumption with less transportation, a smaller percentage of a region's population, and a better cycle of materials between the city and its environmental surroundings as well as a more efficient spatial pattern.

As the use of fossil fuels decreases, the economy will shift to an agrarian base with a lower-intensity agriculture using less technology, fertilizer, and pesticides and more labour, provided by people leaving the cities where employment would be decreasing. Diverse crop varieties that are more self-sustaining will have to be restored, even if their yield might be lower than what the people are currently used to.

Efficient, maximum production requires that everything be reused or recycled (not accumulated in dumps). Even currently, to encourage conservation and reuse of materials, some manufacturers are being required to take back the materials they used in the packaging of their products. As soon as global fuel consumption begins to decrease (as its scarcity and cost increase), the earth processes of carbon-dioxide uptake can start to restore the balance between carbon-dioxide release from fuel consumption and carbon-dioxide uptake by plant photosynthesis, the carbonate buffer of the ocean, the alkaline soils, and the weathering of rock.

The authors believe that it is time for people to recognize what is happening and how they will be forced by circumstances to adapt to the future.

- Using vacuum system where, air velocities within the pickup unit can be adjusted to create multiple pressure drops. Heavier items will drop out first and lighter ones second.

Inclined Conveyors for Light/Heavy Sort

Light containers (plastic and aluminum) are separated from heavy containers (primarily glass) using an inclined conveyor and a series of parallel chain curtains. Lighter containers are directed along the conveyor and discharged off the end. Glass containers pass down the sideslope and are removed. Manufacturers of disc screens, such as Bollegraaf, CP Manufacturing, BHS and Machinex, also produce similar inclined conveyors for separation of containers and miscellaneous fibres.

Trommel Screens for Size Separation

Trommel screens are rotating, inclined drums. They use a combination of rotation and screening to separate materials. The tumbling motion created by the rotation drum shakes loose smaller-sized objects (dirt, grit, bottle caps, broken glass) that exit through holes in the drum. Larger materials exit at the downstream end. Trommels can be designed with a variety of hole diameters, staged in sequence to separate different container sizes. Trommel screens can also be used as bag breakers. For this application, triangular steel "knives" or spikes are welded to the inside of the drum. As bags containing recyclables or mixed waste tumble in the drum, the bags are ripped open. One disadvantage is a pronounced breakage of glass, a problem if glass is to be manually colour sorted and when ceramic content must be reduced.

Trommel/Magnets for Size Separation

Several manufacturers offer a combination trommel screen and ferrous separation. The combination trommel-magnet has a stainless steel tube welded to the end of the trommel. A magnetic field is created in the tube to attract ferrous recyclables. Ferrous materials attached to the inside of the tube rise with the rotation of the trommel. At a predetermined point in the rotation, the magnetic field weakens, allowing the ferrous to drop via a chute into a bin or onto a dedicated conveyor.

Star Screens (Disc Screens) for Size Separation

Star screens are popular in a variety of sorting applications, such as:

- Single-stream MRFs to perform an initial separation of fibre and container materials;
- Fibre sorting applications to separate old corrugated containers (OCC) or old newsprint (ONP) from other fibre grades;
- Commingled container sorting systems, as an alternative to vibratory screens and trommel screens for removing fines, debris, and broken glass from larger containers; and
- Commingled container sorting systems, to sort containers from miscellaneous fibre contaminants.

These screens consist of a number of rotating axles, each containing a number of "star"-shaped wheels. The spacing between axles is adjustable, as is the star diameter. Spacing depends on the sorting function. The screen bed is tilted upward. As the commingled stream is directed onto the lower end of the screen, oversized material bounces along the top in the direction of the star rotation, and smaller material falls through the open spaces between the stars.

Glass Sorting

Mechanical sorting of glass cullet is relatively new in North America. The sorting technologies are more common in larger glass reprocessing facilities, where larger throughputs are necessary to justify the capital outlay for the sophisticated equipment. Optical sorters generally work effectively on glass pieces ranging in size between one and four centimetres. Sorting equipment is operated to remove ceramics from a mixed glass stream, or colour sort a mixed glass stream. Glass-sorting technology is available and in operation in material recovery facilities (MRF) throughout the United States. Some manufacturers claim that a MRF must have in excess of three tonnes/hr of glass throughput to achieve a payback in a reasonable number of years, while others suggest that a volume of at least nine tonnes per day of glass is necessary.

Plastics Sorting

In North America, plastic container sorting at a material recovery facility (MRF) is primarily a manual task. In contrast, in Europe, automation of this process has been implemented more widely because of high manual labour costs. Most automated bottle-sorting systems in North America are located at plastics processing facilities and plastic reclaimers, where the volume can justify the system costs.

The material properties of plastic can be sensed and identified through either transmission or reflection. Transmission identification mode (x-ray, visible light) is used widely to determine resins and colours in plastic reclaiming facilities that have a controlled material stream. It can also be used in some MRFs, where contamination to the input stream is limited. Reflective near infrared (NIR) sensors are used in dirtier MRF applications, where the mixed input material stream does not allow for transmission sensor design use.

Germany has the highest level of automation for sorting equipment. As with all NIR sensors, cost is the major obstacle in having them installed by North American MRF operators. Experience in development and operation of plastics separation systems shows proper feeding and preparation of the feed stream as well as the quality of the sensing system are critical to optimal separation efficiency.

Eddy Current Separators

These are designed to separate conductive but non-ferrous metals from other lightweight commingled materials. This is a mature technology widely used for sorting aluminum in MRFs. There are two basic types of separator designs: one uses a rare earth ceramic rotor to separate small, non-ferrous material; the second, which uses a strontiumferrite-ceramic rotor, has less power, but is ideal for separating aluminum cans. Consequently, these separators can be smaller and less powerful and still achieve high recovery rates. High-speed oscillating magnetic fields are produced, which induce an electric current in the conductive object. The oscillating fields can be adjusted to optimize separation. This electric current generates a magnetic field, which causes objects (e.g., aluminum cans) to be repelled from the primary magnetic field.

A relatively new development is a machine that sorts aluminum based on thickness and is able to differentiate aseptic packages (e.g., tetra boxes) from aluminum cans. The machine senses the thickness of aluminum in a container (using a patented sensor technology) and through use of air jets at the end of a sorting conveyor, ejects the targeted con-

Et cetera...

TRASH TALK
An Inspirational Guide to Saving Time and Money Through Better Waste and Resource Management
Dave and Lillian Brummet
Publishamerica, Baltimore, ***2004***
ISBN 1-4137-2518-X
People are constantly bombarded with negative information about the environment and its resources. Some feel powerless and are overwhelmed by the immense environmental problems the world faces. The authors focus on changing people's mindset to a more open, hopeful and proactive one, not by finger pointing at corporations and governments, but by starting in people's own homes, at their own desks.

This is a refreshing book. It includes many ideas on transforming items formally destined for landfill into useful and needed products. Ideas that inspire participation from the ground level, concentrating on ways the average person can make small changes in their lives, helping the environment and saving valuable resources, such as the many lives of a garden hose.

In June 2005, the Recycling Council of British Columbia (RCBC) awarded the Brummets top honours in the Journalist and Media Educator category "In recognition of outstanding use of various media in ongoing outreach work to reduce waste in our environment." The award was presented during the 31st Annual Waste Reduction Conference 2005 held at Harrison Hot Springs, British Columbia.

Visit http://www.sunshinecable.com/~drumit for more information about the authors, the book, as well as an impressive list of links to various environmental organizations and initiatives.

3rd International Symposium on Feedstock Recycling of Plastics & Other Innovative Plastics Recycling Techniques
September 25-29, 2005
Karlsruhe, Germany
Email: info@isfr2005.de
Web: www.isfr2005.de

New Earth 2005 - Global Environment Technology Show
October 1, 2005
Osaka, Japan
Web: oitfc.fair.or.jp/newearth/

The European Paper Recycling Conference
October 3-5, 2005
Brussels, Belgium
Email: mfitzpatrick@gie.net
Web: www.paperrecyclingeurope.com/

2005 Annual Conference & Trade Show Coast Waste Management Association (CWMA)
October 5-7, 2005
Port Alberni, British Columbia, Canada
Email: info@cwma.bc.ca
Web: www.cwma.bc.ca/events.html

The Recycling Council of Alberta's 2005 Annual Conference
October 12-14, 2005
Lake Louise, Alberta, Canada
Email: info@recycle.ab.ca
Web: www.recycle.ab.ca

The Composting Council of Canada's 2005 Annual Conference
October 12-14, 2005
Lake Louise, Alberta, Canada
Email: ccc@compost.org
Web: www.compost.org

14th European Biomass Conference and Exhibition
October 17-21, 2005
Paris, France
Web: www.conference-biomass.com

tainer over one of two "air knives." This equipment is now used in several French MRFs, typically at the end of the container-sorting conveyor after a positive plastic sort.

NEW AND EMERGING PROCESSING TECHNOLOGIES

There is a trend towards more automation of processing with equipment such as optical sorters for glass and plastic, and disc or star screens for paper sorting. The costs of these new approaches can only be justified by building larger, regional material recovery facilities (MRFs) where economies of scale are possible. Recent research indicates that a single-stream MRF can be constructed and operated for $1.17/tonne more than a two stream MRF, when capital amortization and all other factors are taken into account. This is approximately a five per cent increase in processing costs for a significant reduction in collection costs compared to other alternatives. Single stream MRFs have higher equipment capital and maintenance than two-stream MRFs, but the relatively small increase in processing costs is more than offset by the significantly quicker and therefore cheaper collection involved (estimates indicate a 30% reduction in collection costs). This conclusion is likely to prompt many municipalities in Canada to re-evaluate their current collection and processing operations to find additional cost-savings through system design changes.

This article was adapted from "Solid Waste as a Resource - Guide for Sustainable Communities" produced by the Centre for Sustainable Community Development at the Federation of Canadian Municipalities (FCM). The Guide was written under the leadership of FCM with significant funding and supportive direction on content from Environment Canada, Natural Resources Canada, and the Enhanced Recycling Program of Action Plan 2000 on Climate Change. For more information regarding the contents of this article, or to download the Guide and its accompanying Workbook, please visit http://kn.fcm.ca

Canadian Association of Recycling Industries

Perceptions and Attitudes about Recycling

by Leonard Shaw

Last May, the Edmonton Waste Management Centre of Excellence hosted a conference in Edmonton entitled "Waste – The Social Context". Speakers from all over the world spoke to this theme. This is an unusual topic, but one must agree, a fundamental aspect to the examination of waste management.

Unfortunately, like almost every conference and article on the subject, the inclusion of recycling within the context of waste management just demonstrates the incorrect appreciation of recycling by today's society. CARI attempted to correct this problem by speaking about attitudes and behaviours about recycling.

CARI pointed out that a definition of a perception in the Oxford dictionary was "a way of understanding or interpreting something". Similarly a definition of attitude was "a settled way of thinking or feeling". Importantly the "way" society perceives something and the attitude that it has settled on, determines its actions even when the attitudes

and perceptions are incorrect. It must, however, be noted that neither definition specifies that it must be the correct or the only "way". Furthermore, perceptions and attitudes change with education, with time, and with other developments.

Essentially our society's current perceptions are that recycling is a relatively new activity. In reality, recycling goes back to the Bronze Age. It is only since the end of WWII that the developed world has become a "throw away" society. During the last World War recyclable materials were, in fact, considered strategic materials. Recycling generates significant economic benefits in addition to substantial environmental payback. Certainly recycling is not synonymous with waste management. Products made from recycled content are widely produced today although not often promoted as such by the manufacturers and frequently unknown by consumers.

A lack of knowledge about all of the benefits of recycling is not a major concern but it likely means that there is less support for recycling and issues that need to be addressed in order to maximize its benefits. The general perception of the recycling industry by individuals, government officials and elected politicians, essentially everyone not actually involved in the recycling industry, is that recycling is the process of minimizing wastes by recovering reusable materials.

Fortunately, an attitudinal change seems to be happening, at least in the United States and the United Kingdom.

At a conference last fall the acting assistant administrator for the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response stated that he was convinced that the U.S. must make a sharp and profound change in policy direction. Thomas Dunne said that "for manufacturers everywhere, materials management will become a much higher priority than waste management" and that "the agency needs to concentrate its resources on the second part [of its mandate], developing a national material policy instead of spending the lion's share of its energy writing regulations." Similarly the London Borough of Islington just spent about half a million dollars on a recycling education centre that will open in September. The centre itself is made from recycled materials, provides visitors the opportunity to learn about waste issues and how to recycle products and showcases products made from recycled materials. In addition, the latest phase of a U.K. $20 million multi-media communications program launched last fall and designed for local authorities to boost awareness and encourage recycling, will use a series of humorous radio ads narrated by popular British comedian and actor, Eddie Izzard. These radio advertisements will complement the Waste & Resources Action Program's existing television and print campaigns for the national recycling campaign "Recycle Now."

If Canada cannot lead, it will have to follow. The expanded benefits derived from those with the correct perceptions and attitudes about recycling will eventually ensure that we do.

For further information regarding the above article, or for information on CARI's activities and membership, please contact Dr. Leonard Shaw. Tel.: (613) 256-8533, Fax: (613) 256-8534, Email: len.shaw-cari@on.aibn.com.

Canadian Waste & Recycling Expo
October 26-27, 2005
Vancouver, British Columbia, Canada
Phone: (770) 984-8016
Email: info@usa.messefrankfurt.com
Web: www.cwre.ca

E-Scrap 2005
The North American Electronics Recycling Conference
October 27-28, 2005
Orlando, Florida, USA
Web: www.e-scrapnews.com

Building Materials Reuse and Recycling: Deconstruction '05
November 6-8, 2005
Atlanta, Georgia, USA
Email: guy_brad@yahoo.com
Web: www.decon05.com

World Recycling Conference on Cars, Electronics and Battery Recycling
November 8-11, 2005
Shanghai, China
Email: info@icm.ch
Web: www.icm.ch

Year in Review - 2005 Environment Conference
November 29-30, 2005
Toronto, Ontario, Canada
Phone: (416) 510-6864
Email: rshaikh@ecolog.com
Web: www.ecolog.com/yir

United Nations Climate Change Conference and First Meeting of the Parties to the Kyoto Protocol (MOP 1)
November 28 - December 9, 2005
Montreal, Quebec
Web:
unfccc.int/meetings/cop_11/items/3394.php
Web:
www.cenrce.org/eng/projects/KyotoProtocol/

Pollutec 2005
November 29 - December 2, 2005
Paris, France
Email: ilse_dapper@reedexpo.fr
Web: www.pollutec.com

C&D World Show
January 15-18, 2006
Miami, Florida, USA
Email: mfitzpatrick@giemedia.com
Web: www.cdworldshow.com

International Electronics Recycling Congress
January 18-20, 2006
Hamburg, Germany
Email: info@icm.ch
Web: www.icm.ch/index_electronic_06.htm

ECO Canada Conference 2006
January 26-27, 2006
Toronto, Ontario
Web: www.eco.ca/conference/

ENVIRO 2006
February 7-9, 2006
Manchester, UK
Phone: +44 (0) 8700 433 874
Email: enquiries@enviro2006.co.uk
Web: www.enviro2006.co.uk/

Irish Water, Waste and Environment 2006, Irish Recycling & Waste Management 2006
March 8-9, 2006
Dublin, Ireland
Email: rudi.blackett@fav-house.com
Web: www.environment-ireland.com

International Automobile Recycling Congress
March 15-17, 2006
Amsterdam, Netherlands
Email: info@icm.ch
Web: www.icm.ch/

GLOBE 2006
March 29-31, 2006
Vancouver, British Columbia, Canada
Phone: (604) 775-7300
Email: info@globe.ca
Web: www.globe2006.com

17th Global Warming International Conference
April 20-21, 2006
Miami, Florida, United States
Email: gw17@globalwarming.net
Web: www.globalwarming.net/

At first glance the Internet is like a huge metropolis. There are businesses of every size, libraries, schools, colleges and universities, federal, provincial and municipal governments, industrial sites, financial districts, and hospitals as well as large residential areas with cafes and meeting places. People in this city work and study, take vacations, bank, and shop. Libraries offer daily newspapers, maps, and reference books; their catalogues are full of popular and scientific literature. The daily press may be searched for topics of interest. At an educational institution, one can talk to experts in their field and converse with students, and the university library contains scientific journals and books that may be browsed. Some of the universities have open courses where the public can study for pleasure without actually earning a degree. A city register might provide names of various businesses. If current legislation is needed, the federal, provincial and municipal governments may be contacted.

Professional associations around the globe have Internet sites, with directories of their members usually opened to the public. These sites feature conference announcements, news releases and sometimes newsletters. Recycler's World (***www.recycle.net***) contains an impressive listing of professional associations around the world. A large number of businesses of all sizes are present on the Internet. Some of them have web pages that are nothing more than an advertisement; others list the full spectrum of their business activities. Usually all of them provide either a "contact us" feature or list their address, telephone, and fax numbers directly on their web pages making contact with them very easy.

When a specific legislation is needed one should contact government pages. The Government of Canada operates an Internet portal (***canada.gc.ca***). The portal provides links to all government departments and agencies. One can search the content of the entire Government of Canada portal or enter a particular department, such as Environment Canada, Industry Canada, or Natural Resources Canada and perform a localized search. The Government of Canada offers almost all of its publications in both printed and electronic versions. The Government of Canada portal contains links to the official government Web sites of Canada's provinces and territories, where one can explore regional issues, rules, regulations and legislation.

The European Union portal EUROPA (***europa.eu.int***) contains news sources, highlights activities, institutions and legislation, and displays a large number of documents. "Information sources" pages gather a wide range of sources of general information and contact details spanning all the European Union's institutions and agencies. Again an extensive search tool is available.

At this moment, except for the European Union, which provides information in 20 languages, information on the Internet is mostly posted in English. Sites in languages other than English are springing up very quickly. What is lagging behind is a universal translator, which could allow people in different countries to communicate through a common interface.