

**EVERYTHING
YOU EVER
WANTED TO
KNOW ABOUT
RECYCLING...**

**BUT NEVER DARED
TO ASK!**

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INTRODUCTION: ECOLOGICAL PRESSURES DEMAND ACTION

There was a time in North America when recycling wasn't even a word most people were familiar with, and it wasn't very long ago. Within a single generation, it has become a household word, but the stakes for not doing so have continued to increase.

This book seeks to illustrate the need for action, current practice, vexing problems and future solutions that will lead us towards a sustainable future that serves everyone.

DIFFERENT TYPES OF POLLUTION

There are three major types of pollution that are the primary systems affected by any particular contaminant. However, they are all so very interrelated that one type of pollution inevitably leads to another, indirectly.

When one considers how profoundly waste impacts all different types of pollution, the need to do something is clear and a zero-waste society where everything is either reused or recycled into something else is the only way to significantly manage this.

AIR POLLUTION

There are three major types of air pollution, all of which are produced in conjunction with the creation of waste.

1. Greenhouse gases such as carbon dioxide and methane
2. Ozone destroying gases, including CFCs and other chlorides
3. Smog producing gases and particulate matter that contributes to respiratory ailments

These elements eventually float up to the upper atmosphere to do long-term atmospheric harm or fall back to earth as toxic dust or acid rain. Either way, most air pollution eventually makes its way into the water supply or winds up coating and adhering to the soil.

MAN-MADE CHEMICALS

Landfills and household waste contributes air pollution in the form of man-made materials that release novel and synthetic breakdown products into the local atmosphere through a process known as "off-gassing." This has unpredictable effects in the home as well as the landfill, with various breakdown chemicals synergistically reacting with each other and causing unpredictable effects.

Some of the more notable synergistic combinations that are now being discovered in very common waste and food items are targeted neuron damage and super-hormones that have already been shown to impact the health and development of creatures across the board, though fish and amphibians are especially sensitive¹.

METHANE

However, the greatest amount of air pollution comes in the form of methane gas. This is released in massive quantities from both farm animals and landfills. In the case of the latter, it's due to the anaerobic (without oxygen) breakdown of organic waste by micro-organisms that creates the methane.

Methane (CH₄), a simple organic molecule², is at least 75 times as powerful a greenhouse gas as carbon dioxide over the 8 or so years that it's likely to remain tumbling around in the upper atmosphere. However, the carbon dioxide that it eventually breaks down into will remain floating around and warming the Earth for as long as a century or more.

Since 2000, a few facilities have taken advantage of the energy contained in methane (aka, natural gas) and begun to produce power from the gas that's produced. Other facilities simply "cap" the landfills when they're no longer in active use and just let it out slowly, in an effort to prevent trash explosions. However, there remain countless facilities that simply vent methane in small explosions of this so-called "swamp gas."

Emissions of methane from what scientists call "anthropogenic sources"³ include that which escapes from landfills, trash and other organic matter

¹Since they grow and develop in aqueous solution, such creatures are essentially immersed in a chemical bath

²Defined chemically as anything containing carbon, not to be confused with the agricultural definition that applies to produce in the marketplace.

³As opposed to natural emissions that include wetlands, termites, rice cultivation and natural hydrates at the bottom of the ocean

that's burned and waste treatment plants. It should be noted, that the vast majority of the thousands of landfills in North America continue to belch out methane from table scraps that were dumped in during the Cold War.

OZONE-DEPLETING CHEMICALS

Another type of air pollution that is a direct result of the use of landfills are escaping CFCs and other ozone-depleting chemicals from old air conditioners and refrigeration units. While these have been largely drained out of equipment since the 1990s, there are many decades worth of old refrigerators that are slowly leeching these chemicals out. These aerosolize and make their way into the upper atmosphere and will continue to do so for many years to come.

WATER POLLUTION

Perhaps the most egregious examples of pollution that come from landfills and the waste that escapes from them are the tens of thousands of man-made chemicals that are spilled (or simply dumped) into ground water and surface water, alike. Groundwater is the most likely to be contaminated with the myriad of petrol-chemicals, pesticides, herbicides, toxins and drugs, as they eventually leak through the soil and into aquifers.

It is estimated that nearly half the North American population relies upon this groundwater exclusively with that number becoming very high in rural areas. As the sources of groundwater become more scarce, the pollution of that which remains is increasingly a concern, especially since it is far less diluted than it was even just a few decades ago.

Waste-generated pollutants can come from municipal landfill that are full of household goods, appliances and organic wastes. Contamination can also result from hazardous waste dumps that store anything from paint thinner to old light bulbs. There are even instances of radioactive contamination from old smoke detectors that have turned up in some landfills, which are expected to continue polluting for the next several million years.

Landfills constructed after the 1970s are very often required to have an impermeable and flexible liner that will hold the landfill leachate in. However, the longest lasting liners are not often rated for over 30 years and cannot be tested against everything that is likely to be dumped into a municipal landfill.

SOIL POLLUTION

Perhaps most pervasive is the pollution of the soils around landfills or wherever waste is dumped. In fact, for all the items that make it into the local environment instead of the landfill, they will all come into some sort of contact with the soil. No matter how much sod is put on top of these sites, the soils have been shown to remain highly toxic for decades (and likely, centuries) to come. This means that crops cannot be grown on that land. Even trees that do survive to drive their roots into the rubbish will bring toxic chemicals to the surface with every leaf.

Soil is a complex combination of living organisms, high-carbon organic matter and mineral substrate. Each part of a "soil system" interacts a little differently with every bit of trash that makes its way underground. Organic matter and clay soils, for instance, have a buffering effect on many different types of pollutants that leak into the soil. This allows extra time for these chemicals to break down in the environment, often into even more toxic by-products.

Like water pollution, common contaminants as a result of rubbish include both household and hazardous waste products. Pollutants are dumped directly on soils or land there as a result of particulate matter that wafts down from polluted air.

Generally, the finer the soils, the longer it takes for the pollutants to be washed into either the surface or groundwater supplies. Sand, for instance, allows pollutants to be very often washed into rivers or the sea with very little soil interaction. It takes so long for pollutants to work through the clay that many landfills have been built on since the 1980s, that these wastes almost always migrate towards groundwater, instead.

Not only is human health impacted by soil pollution, but that of wildlife and even the microbes that support soil building. In some US states, nearly 10% of crop-lands are polluted to the point where detectable residues are found decades later and yields are a fraction of non-polluted lands. While such crops can be grown for use as ethanol, there is no guarantee⁴ that such crops won't end up being fed to animals or even in the human food chain.

Since the 1980s, many landfills have become Superfund⁵ sites in the US, making polluters liable for the amount of money required to clean them up, which can range from a few thousand to several million dollars, depending upon the type of contamination, the scope of the clean-up and the danger to the environment and human health.

While many such sites were cleaned up in the 1990s, work on the nearly 1,500 that have been identified as priorities have been largely halted during the 'aughts. During the 1990s, money for clean-up was appropriated

⁴Due to an organized and staunch resistance to any type of monitoring by the USDA or FDA

⁵In accordance with the 1980 CERCLA legislation

through taxation and fees levied against polluters. The fund that was at over \$6 billion during the most active phase of the clean-up, was depleted by 2003, and tax dollars have been sparingly appropriated since.

THE THREAT TO PLANETARY HEALTH

Since all these systems are interrelated, it is clear that the threat posed by waste-related pollution is extreme and impossible to contain. As a result, it also threatens, directly or indirectly just about every ecosystem and organism on Earth.

DIRECT WASTE-RELATED THREATS

Chemicals, seepages and spills from landfills and other types of waste disposal sites have a profound impact on all types of living things and the environments they depend upon. For instance, many different types of very common plastic waste and pesticides break down into powerful hormone mimicking substances called "endocrine disruptors." These have been shown to alter reproduction, growth, development and behavior of many different types of sensitive species⁶.

Other direct impacts are seen in the massive floating dumps of plastic and other waste that have been observed in the open ocean, such as the so-called Great Pacific Garbage Patch. Animals that live in these areas have been found to be so full of garbage that they can no longer digest food.

⁶Waste-related dysfunction has been seen in hundreds of animals in dozens of studies, including amphibians, reptiles, birds, mammals and insects.

INDIRECT WASTE POLLUTION

Even direct sources pale in comparison to the many different types of indirect damage that is done to all different types of life, disrupting eco-systems and causing ill-health throughout food-chains throughout the world.

For instance, consider the vast-reaching effects that climate change has upon the health of species being displaced on an unprecedented scale. Not only is the generation of all this trash extremely wasteful of carbon dioxide producing power, but it also contributes to the generation of even more damaging methane, exasperating the problem.

Another example might be the unbridled use and poor disposal practices that contribute to the downfall of pollinating insects. Not only is there a direct consequence is those populations, but plants that rely upon those insects are declining as a result, causing less food to be available to animals that rely upon these food sources, humans included.

ECOLOGICAL THREATS TO HUMAN HEALTH

It should come as no surprise that anything that impacts the health of Earth as a whole will must impact human beings. Nowhere is this more apparent than in the case of human health. Human health is impacted greatly by these pollutants in countless direct and indirect ways.

Contaminated soils that grow crops for both human and animal consumption tend to bio-magnify these chemicals. They are stored in human tissues and continue to react with each other throughout each person's life-span. Many of the chemicals and metals commonly found near landfill sites are known to cause endocrine disruption, nerve damage and immune dysfunction.

The fact is, no one is entirely sure what the long-term effects of being drowned in our own waste will eventually cause. However, ever-increasing rates of very serious diseases and disorders are being observed throughout North America.

In short, the problem is very serious and becoming more serious every day. Recycling is one part of the process by where the root causes of our trash habit can be addressed. There has, and always will be, waste as a consequence of people living on Earth. What we choose to do with it makes all the difference.

1

HOW RECYCLING WORKS

There are as many different types of recycling as there are different types of goods to transform into new uses. People have been known to practice recycling in one form or another for several thousand years. Whenever things that are used everyday become scarce, people start reducing, reusing and recycling.

Little has changed except that we are now able to see the problem in much clearer definition. Recycling provides a tangible way to address the problem in the near-term future.

A RECYCLING OVERVIEW

In its most basic form, recycling is the process by where waste is turned into something useful. This can be in the form of creating totally new materials from old ones, stripping valuable materials from complex items or turning waste materials back into the very same packaging and containers.

Recycling seeks to save energy and materials while decreasing pollution and the amount of land that is dedicated to storing all the waste. It is only one component of the overall "waste hierarchy"⁷ that those who study sustainability have identified as the best way to use finite resources with minimal damage. However, the sheer volume of materials that can be recycled makes it a very important aspect of a larger sustainable development approach.

Recycling can directly reduce the negative impacts of human society on the world and its own viability when widely adopted. It can also indirectly encourage people to think differently when they make purchases and how they approach consumption. Taken together, a zero-waste society is more than possible, it can actually be highly profitable.

⁷Listed in descending order of usefulness in a truly sustainable waste stream: Disposal, energy recovery, recycling, reuse, minimization and prevention.

SAVING ON MATERIALS

Perhaps most directly, recycling decreases the inputs that generate “virgin-materials. Whether animal, vegetable or mineral, the pressure on the natural resources of North American nations is a tangible commodity in its own right with ecological, political and economic ramifications.

FORESTS

Unlike many commodities, much of the wood for American paper products is sourced from trees grown in North America. Not only does North America supply wood for nearly 40% of the world's paper, but it also imports about 15% of its own paper use. In fact, about 35% of the trees (or nearly 70 million trees) felled in North America are destined to become some sort of paper or cardboard each year.

The wood and wood pulp industries are not just confined to the borders of Canada and the US. China, for instance, has grown into the second largest producer of wood and paper products since barely being able to meet its own needs in 1990. Nearly all of this growth, however, is based upon the importation of paper recycled by consumers in North America. In fact, their use of imported paper has grown, by about 30% annually – much of it sent back to North America as boxes and packaging for new consumer goods.

Now, consider how many trees can be saved by recycling all this paper. By some estimates, about 20 million acres of trees could be saved annually if half the paper in the US were recycled. The amount of wood pulp⁸ that can be saved per ton of paper recycled depends upon whether it is post-consumer waste, what process is used to manufacture it, what type of paper it is and what it's being recycled into.

Office paper, for instance, takes twice as much wood pulp to produce as newspaper, but conversely, it also yields twice as much usable recycled material to be turned into new paper, paperboard and cardboard. Also complicating matters is the relative benefit of tree harvesting given that nearly all companies in North America who harvest trees are also required to replant at least as many acres as they fell.

With regards to detractors who claim that replanting is actually of greater benefit, overall, it is worth noting that even the fastest growing trees take decades to reach a harvestable size. An old growth community of trees that is capable of supporting the full diversity of creatures that are an important part of forest eco-systems may take between 300-500 years to fully

⁸90% of paper is made from wood pulp - other sources include cotton, flax, hemp and bamboo fibers

establish, while trees “maintained for harvest” are usually taken at 30-80 year intervals depending upon the species and climate involved⁹.

Seedling trees are also incapable of stopping erosion for many years – even a solid ground cover isn't nearly as effective at reducing the power of raindrops or absorbing surface water as the roots and massive canopies of old trees. It may, therefore, shock some people that the few remaining stands of old-growth forests in North America contribute nearly 10% of the paper pulp produced there each year¹⁰.

However, the demand just keeps going up. By the mid-1990s, the demand for paper was causing trees in the south-eastern US to be harvested faster than they could grow, for the first time since people began keeping track. In short, recycling both newspapers and office paper at high rates could not only save many trees, but also the carbon dioxide those trees will continue to take up and use for years to come, the soil that will remain in place and the energy required to cut down, collect and process those trees.

Of course, paper isn't the only item that can be recycled to save trees. Furniture, homes, palates and every wooden piece of knick-knackery that's made of wood. The re-appropriation, up-cycling and down-cycling of these items also has a profound impact on the number of trees that must be cut down for the purpose.

In countries such as those in South America, this often includes exotic hardwoods from old-growth forests. Recycling other types of wood products can also have a significant impact on the number of trees that are harvested each year.

WATER

Perhaps of more immediate and direct importance to human prosperity and survival is an adequate supply of fresh water. Recycling has the potential to save massive amounts of fresh water in the case of several recycled commodities.

Again, paper is one of the biggest users of fresh water and continued increases in the amount of paper and wood products that can be recycled are also significant in terms of freshwater that is saved for human consumption. Not only is water saved in the recycling process, but the amount of water that is contaminated with a wide variety of acidifying chemicals and other pollutants¹¹ is decreased by as much as 70%, according to some estimates.

⁹The US average cycle is 25-35 years

¹⁰As of 2004

¹¹Often before being released back into a natural environment such as wetlands or rivers

The same is certainly true of mining operations which contribute a great deal of contaminants to water – nearly all of it freshwater – that usually leaves a processing plant heavily polluted. While there are regulations that govern effluent from US mining operations, these can be poorly enforced. Laws in Canada and Mexico are generally less strict (or even voluntary), often depending on the proximity of such mines to a human population center.

ORES

Not only does the extraction of ferrous¹² and non-ferrous ores use a great deal of energy in the form of earth movers, processing equipment and transport, but the environmental damage from their processing is vast. Fish and other aquatic populations suffer profoundly and directly as a result of mining operations. Even higher-order animals that feed on such fish have been shown to be adversely affected when feeding on fish and invertebrates that come into contact with mining effluent and mine tailings.

A great many ores can be easily reused and melted down without degradation from recycled materials. For this reason, scrap metal drives have historically been important in times of war (going back thousands of years). Metals used in packaging and commerce, such as the ubiquitous aluminum can, save tremendous amounts of energy, water and environmental damage with each ton that's recycled.

SAVING ENERGY

When considering environmental impact and what could very well be one of the greatest challenges of the 21st century, one must consider the likely impact of climate change. While the jury remains out on some of the specifics, public consensus in North America has caught up with the rest of the world, agreeing that something must be done. The stakes are certainly very high and carbon dioxide has emerged as the biggest contributor, though it's far from the most powerful force – it's just one of the very few that has changed much.

Until the majority of electric power in North America is produced using renewable resources such as wind and solar, the generation of power will essentially be the generation of excess carbon dioxide. Even hydroelectric projects are not immune from criticism, given their propensity to destroy fish runs and other habitat for the aquatic life of the arid West.

The ability of recycling to save energy, therefore, has very far reaching consequences. And, this has been shown to be a reliable consequence of all

¹²Iron and iron-containing alloys such as steel

different types of recycling, to varying degrees. In fact, in a recent compilation of EPA reports¹³, all major types of recycling were rated according to how much energy the most common recycling technologies and collection schemes saved over the processing of "virgin" materials.

In the case of aluminum, an over 95% energy savings is easily achieved when compared with the energy spent processing and cleaning up after raw ore. Other materials offered similar energy savings, with metals and plastics showing the most energy savings. Meanwhile, glass, which has been recycled longer than any other material, actually saves the least energy¹⁴.

Recycling not only saves energy directly, but it is also key in the larger goal of stimulating development and investment in renewable energy sources. Methane plants, for instance, are a direct result of people taking a closer look at waste and trying to figure out how to make something out of everything.

Now that the US is getting (arguably) closer to signing on to international agreements to cut carbon,¹⁵ recycling is becoming a very important part of reducing overall carbon emissions. With the advent of "cap and trade" schemes, industries that cannot cut their emissions (such as airlines) can trade with industries that can, such as aluminum smelting.

REDUCING POLLUTANTS ON SEVERAL FRONTS

Clearly, recycling is capable of saving all different types of pollution, whether on land, sea or air. The direct pollution of waste products sitting and decomposing in landfills is just one type of pollution that recycling discourages.

For instance, the carbon dioxide that is saved through direct, petroleum-derived energy savings is just one component of recycling savings. Less directly, many recycling plants are run on alternative or renewable fuels¹⁶. The use of recycled materials often saves on shipping costs, when the materials are used domestically.

There is also evidence that suggests that when people commit to recycling programs in their daily lives, they often start paying more attention to just how much waste they are generating in the first place. When people recycle,

¹³All data from 2007 save the data from cardboard and glass figures, circa 2005

¹⁴Largely due to its weight and sorting headaches

¹⁵The US remains the only industrialized nation in the world to have not ratified the Kyoto protocol. Both Canada and Mexico are on board. The likely election of a liberal government in the US is expected by many to bring about ratification by 2010.

¹⁶Though this certainly hasn't always been the case in urban areas until the mid-'aughts

for instance, they are generally more interested in purchasing products that are made from recycled materials whether it's toilet paper or rain gutters.

CREATING JOBS

One of the most important aspects of recycling programs as they exist in individual communities is the creation of living-wage jobs. This has certainly been the case in many urban areas where the job of sorting and cleaning materials for the recycling stream has been preferentially given to homeless populations.

Jobs in the renewable energy sector and directly in recycling schemes has been one of the few growth industries in many areas, including both urban and rural populations. In the case of self-employed people, the use of recycled materials has provided valuable materials for the burgeoning DIY industries, cushioning the rise in unemployment that has plagued many communities in the mid- to late-'aughts.

It is expected as the investment in recycling and alternative energy programs increases, public sector dollars will continue this trend towards job creation in these sectors as the much-touted "green jobs" supported by many progressive leaders.

THE LANDFILL STREAM

Obviously, the recycling of materials keeps a significant amount of material out of the landfill stream. Because of recycling programs, the overall increase in the amount of waste generated in North America has resulted in an overall decline in the amount of material that goes into landfills.

More importantly from a city or county budget level, trash that goes into landfills costs money. In fact, it's the norm for landfill disposal to be supported by tax dollars as well as the fees collected by trash haulers. This is especially true in the case of trash haulers and communities that do not operate their own landfills, often requiring a long commute by truck or train to a far-flung landfill site.

By way of comparison, materials that are recycled usually generate revenues. While there has been some difficulty in the past finding good and stable prices for recycled materials, this has stabilized throughout the 'aughts, providing a steady income stream for many communities.

URBAN VS. RURAL RECYCLING

Recycling rates in urban areas have, for a very long time, been much higher than in rural areas. In no small part, this is due to the ubiquity of curbside recycling programs that make it just as simple for most city-dwellers to recycle as to throw trash away.

In rural communities, however, many people are responsible for hauling their own trash away. Such areas have long been responsible for far more trash burning than in urban areas where the practice has largely been banned since the 1970s. Rural dwellers, however, have long deposited far less organic waste, either burning or composting the materials.

The closing of many landfills in rural areas has also increased the rates of recycling in many communities. As the local landfills close, it becomes more expensive for rural-dwellers to get rid of their trash, encouraging recycling from a purely economic standpoint. Even though the return on recycled materials is somewhat lower (due to the longer distances that materials must travel to a recycling facility), there is a great deal of material that has henceforth been destined for landfills, especially among the most easily recyclable materials such as plastic bottles and aluminum cans.

Another seemingly unrelated incentive to recycle has come from the tourism industry. Many rural communities that have lost population and economic opportunity since the 1980s have attempted to revitalize their economies through tourism. Since the largely urban travelers that such communities are actively courting expect recycling programs, many communities have established recycling programs to serve the visitors.

In lieu of distributed networks of collection, as they exist in urban centers, most rural areas are moving towards centralized collection areas. One of the most popular ways to coordinate this involves the use of mixed-waste bins that are picked up at convenience stores, Boy Scout troops and other community gathering places.

Another difference between urban and rural recycling programs is the quality of recycled products that are delivered to the marketplace. Often this is a function both of the age of the program and the level of political commitment to the programs. In most rural areas, the quality and cleanliness of recycled materials is considerably less than that of the urban centers. It is hoped that as the rural markets mature and the cost of virgin materials increases, recycling programs in these areas will step up in terms of quantity and quality.

THE MANY FACES OF WASTE

There's no lack of materials that can be profitably recycled. Some of the more common ones have been used and recycled for many decades, while others are just now being recycled as the ever-increasing cost of fuel and fuel-related pollution has made recycling more attractive.

Chiefly what varies between these materials is the ease with which they can be prepared for recycling and the number of products that they can be recycled into. This will continue to change as resources become more scarce and the recycling industry matures.

PAPER PRODUCTS

North Americans use a lot of paper – about 700 pounds per person in 2005.¹⁷ That's a staggering amount, and one that's expected to rise by half again as much by 2010.

Despite North American landfills being nearly 35% discarded paper that could be recycled, municipal paper capturing programs are actually rather effective. In the 'aughts, the worldwide average of paper recycling now captures nearly 40% of post-consumer waste. From here, it's turned into new paper and structural products.

However, not all paper is created (or recycled) equal. There are differences between grades of paper as well as the rates of recycling between them. The waste-paper stream is generally broken up into pre- and post-consumer waste. The latter contributes far more to landfill waste and pollution, the volume of pre-consumer paper waste that's recycled is both greater and saves more transport energy.

Newspapers, magazines and catalogs

Even though the readership of newspapers has been steadily declining for at least a decade, they remain a massive sink of wood-pulp resources. Though thin, the pages are usually quite large, adding to the mass of newsprint that is recycled in North America each year. This has actually been one of the longest standing recycled materials, having been collected for wartime use and Boy Scout drives for decades.

Rates of newspaper recycling in North America is about as high as that of aluminum cans – over 75% in many areas. This is partly due to a very long history of recycling, making consumers very accustomed to separating out this commodity. The amount of recycled fibers found in most newsprint has also increased from nearly nothing in 1990 to over 30% in 2005.

¹⁷Slightly less in Canada and, as compared with about 100 pounds in Mexico

Magazines and catalogs, on the other hand, are far less recyclable than newspaper. This is partly due to their glossy coatings that can contain as much as 25% of sludge after recycling, and many recyclers are less inclined to take such paper products, since sludge represents rather high disposal costs that cut into their profits.

Office paper

Despite the now decades old personal computer era that promised a "paperless office," 95% of business records in North America are stored on paper. Moreover, the average office worker prints out nearly 30 pages from their computer every day.

The good news is that a rather large amount of this paper is recycled each year, and it increases each year. Since the early 1990s, the rates of office paper recycling in urban areas have increased from less than 20% to over 50% in most markets¹⁸.

Office paper, also happens to be very highly recyclable. It has a high amount of pulp per sheet. Also, the inks from printers are easily removed and contribute a relatively small amount of the highly toxic "sludge" that's recovered in recycling operations. Therefore, office paper is very often turned right back into office paper or high quality newsprint.

Cardboard

One of the biggest uses of recycled fibers is in the manufacture of cardboard for packaging and shipping materials. In the 'aughts, it is not uncommon for cardboard to be at least 20-30% recycled materials, with 100% recycled cardboard also being increasingly common.

It is also recycled at a very high rate – nearly as high as newspaper. Urban areas often see corrugated paper recycled at rates in excess of 70%.

¹⁸As of 2006

Paperboard

While communications have traditionally been the biggest users of paper, packaging has actually been the biggest consumer of paper, very often in the form of semi-rigid paperboard. This material is found in all types of products – the range is truly vast and increasing. In markets where paper

The recycling of paperboard is often complicated by the inks and waxes that must be removed before the recycled fibers can be recovered. In fact, many paperboard materials are impregnated or coated with waxes and plastics that make them difficult to recycle. As a result, many young or small recycling programs do not take paperboard or are very selective about what types they remove during the sorting process.

GLASS

One of the most ancient container materials, glass also has one of the longest histories of recycling. However the energetics of glass and glass transport are such that recycling is very often not the best option, though it is certainly less wasteful than recycling.

It is estimated that it requires about 30% less energy to produce a recycled bottle as compared to a “virgin” bottle. This is somewhat lower than the energy savings that are found when recycling other types of materials. Moreover, since different colors of glass must be separated, the sorting process is complicated by a great deal of manual labor.

While glass is a quite inert substance that doesn't cause pollution, it does take up a great deal of space and requires quite a bit to be heated and fashioned into containers. It does, however, take up space in a landfill and presents a hazard when freshly broken.

Brown and amber glass

Most commonly used for beer, chemicals and other photo-sensitive liquids, brown glass is found nearly everywhere, especially in laboratories, apothecaries and grocery stores. While all these different types of bottles can be reused, very few of them are. Of the various uses of brown glass, beer bottles are, by far, the largest single constituent of it.

There have been several US states that instituted “bottle bills” that pay a deposit for each bottle brought back for recycling. As such, these states enjoy a far higher rate of recycling return than states and provinces without them.

Green

Consumption patterns have a great deal to do with the balance of what products and packages are available to be recycled, and green glass is an example of a product that makes its way from one part of the world to another. For instance, wine producing countries are very often net importers of green glass while the areas wine is imported into have a dearth of it.

Clear and slate

The most often reused glass is the clear types that are used for jars and milk bottles. There has been a resurgence in the use of clear glass containers since the polycarbonate plastics that had largely replaced glass since the 1970s was recently found to contaminate their contents with powerful endocrine disruptors. Nowhere is this trend more powerful than its use as baby bottles and as baby food jars.

However, there are several market barriers to keeping grocery items in plastic. Perhaps the most powerful is the beverage lobby that prefers to keep tighter control over the shape of bottles for marketing purposes. Grocery retailers are also resistant to collecting these bottles because of the fuss.

Clear glass has also been very widely used with incandescent light bulbs that are generally not recyclable. With the advent of compact fluorescent bulbs, the rates of light bulb recycling have gone up considerably as these are collected as hazardous waste, owing to the mercury that these contain.

METALS

Both ferrous and non-ferrous metals are very highly recyclable. Those types that are made into relatively pure containers tend to have a much higher rate of return. They are also more highly prized by recyclers since there is far less separating and processing that's required as compared with more complicated materials, such as consumer electronics.

Aluminum

Among the most recyclable materials that is commonly collected in curbside programs is aluminum. Not only is its use very common, in the form of beverage cans, but it can be recycled again and again without any loss of strength. The process of recycling aluminum saves about 95% of the energy and air pollution of processing raw ore.

Building materials such as aluminum gutters and siding are also highly recyclable, provided the paints and dyes used in their processing can be separated. The rates of recycling these materials are supported by state, provincial and local regulations and programs that encourage builders and remodelers to collect them.

Steel

Ferrous metals such as iron and steel are also highly recyclable. This includes food containers, but also includes many different types of scrap metal such as that found in the millions of automobiles that are decommissioned each year.

PLASTICS

Since the 1960s the use of plastics in packages and containers has risen dramatically. Today, several millions of tons of plastics are manufactured and used each year in North America. Many of these bottles and containers are destined for a single use before being tossed, very often into a landfill. Even when plastic bottles are recycled, the odds of these materials being actually recycled are shockingly low.

Plastics are, of course, made from petroleum. By some estimates, the amount of fossil fuels that are currently being used to create plastic water bottles in the mid-'aughts is enough to fuel every vehicle in North America for several weeks. Moreover, they take an average of 700 years to even begin to decompose in a landfill.

When recycling programs were instituted in the 1970s, plastics were not among the items picked up. It was not until the 1990s when even the most basic plastic recycling was first instituted in municipal recycling programs. Even well into the 'aughts, the rates of plastic recycling are still very low – about 25% in North American cities that accepted plastics as of 2005.

The plastic numbering system, also known as the “resin identification code” was adopted in the late 1980s to encourage recycling, even for type of plastic that do not currently have a viable recycling method. The HDPE plastics that are identified by code #2 are the most often recycled materials in North America and constitute the vast majority of beverage bottles¹⁹.

CONCRETE

¹⁹But not their caps, which are nearly always made of a type of plastic that is not currently recyclable, as of the late-'aughts

As a building material, concrete is perhaps the most widely used material for building on Earth since the mid-20th century. It does, however, require a very large amount of energy to mine the constituent components and even more to form it into a usable substance. It is either poured directly or shaped into blocks or molds.

Concrete is most often recycled into new types of concrete, or used as fill when broken up into chunks. This crushed fill can be used to fill cages in the construction of barriers, as fill for road construction and crushed into aggregate for new concrete.

Rates of concrete recycling have gone up considerably during the 'aughts, partly as a result of higher fuel costs. It is also very bulky and takes up a great deal of space in landfills when not re-purposed for use on the surface.

BATTERIES

People use batteries in ever-increasing numbers, especially as personal communication devices and other portable devices become increasing part of life for every man, woman and child. They come in many shapes and sizes, as alkaline or rechargeable batteries that can take a very widely varying number of charges.

Some of the most toxic materials commonly used in batteries, such as mercury, have been largely replaced by more benign and recyclable materials. That said, there are still quite a few materials very commonly found in batteries, such as lead and cadmium, that are quite toxic when disposed of in a landfill. Most batteries are considered hazardous household waste by most recycling programs.

The rate of recycling varies considerably depending upon the type of battery used. For instance, automotive batteries are recycled at a very high rate – over 90% in many areas. This is largely thanks to mandated recycling programs that require manufacturers to take the batteries back when their useful life is over.

Alkaline

Once the only type of battery that was commonly available to consumers, they represent a continually decreasing share of the battery market. That is not to say that billions of alkaline batteries are not still produced, consumed and (very often) tossed into the solid waste stream.

However, it is reported by the battery industry that, as of the mid-'aughts, sales of rechargeable batteries are at least twice the sales of non-rechargeables.

Recyclable

Not only is there a different type of battery for just about every portable device, but they are made out of a large variety of materials. The recyclable batteries that are made to replace the common alkaline types are made of far fewer different materials, but enough to complicate recycling efforts, anyhow.

Of course, the use of rechargeable batteries, itself, does keep a very large volume of material out of landfills. A typical rechargeable AA battery can save thousands of alkaline batteries over the rated lifetime of such a device. The massive market for portable power for power tools, mobile phones, portable listening devices, laptop computers and many more. Even cars may have large rechargeable batteries to run on in the near future²⁰.

Though most manufacturers now take their batteries back for refurbishment and recycling, this still leaves a very large number of batteries that are all but impossible to do anything with, other than take them to a toxic waste incinerator. And rechargeable batteries are made of some rather toxic materials. The major recycling operations in North America will accept batteries that include nickel-cadmium, nickel-metal-hydride, lithium-ion, nickel-zinc and even small sealed-lead batteries²¹.

Other recycling schemes allow for third party manufacturers to take the shells of recyclable batteries and exchange the "cells" with new ones. This does not address the disposal problem of all those spent cells, many of which contain rather toxic materials. Simply sending these batteries to China for them to worry about is not a solution, since they almost always end up in a landfill or being burnt in an incinerator, only to waft back over the Americas as air pollution²².

WOOD AND TIMBER

Scrap wood products don't simply have to be burned. They are very often able to be recycled in to products that range from aggregate wood products to paper. It is even possible for rough types of wood to be turned into fine products such as furniture, building supplies and decorative objects.

²⁰Current models in production and development use lithium-ion technology, as is commonly seen in laptop computers

²¹As opposed to the large sealed-lead batteries found in automobiles that are handled by different organizations

²²Just in case you don't find contributing to the pollution of other countries troublesome

While the recycling of wood is most often thought of as “re-purposing,” the effect is the same. What makes the most difference in terms of sustainability is whether the products are “up-cycled” into more valuable products or “down-cycled” into less valuable products that are likely to wind up in the trash stream sooner.

One example of up-cycling might be taking wooden pallets and crates that are made of exotic woods from South America and turning them into furniture or flooring. Down-cycling would be turning those crates into paper pulp or firewood.

Waste wood comes in many forms, whether it's a tree you cut down in your front yard or the left-over bits of lumber that may be lying about after a home construction project. This can be done by a professional service²³ or by yourself.

OIL

Most areas have strict controls over the disposal of waste oil, and many municipalities collect it at the curb in very specific containers. The alternative, which many people have wittingly or unwittingly engaged in is to simply dump it down a drain. Storm drains very often empty into the nearest waterway, but household drains are very often recycled back into the drinking water supply with varying levels of treatment. It is for this reason (and others) that most drinking water supplies in North America are tainted with fuel and lubricant additives such as the MTBE²⁴ found in gasoline and drinking water.

Of the roughly half a billion cars and trucks on the road in North America, most have their oil changed every few months. Assuming an average of 4 quarts (3.8L) per change, and a 3-month interval, that's 2 billion gallons (7.5 thousand million liters) of waste oil every year.

However, it's not only lubricating oil that get spilled into the environment – gasoline is also spilled, and rather difficult to recycle. Most often, old gasoline is used to start fires or as a solvent, since the chemical structure rapidly breaks down in storage without octane-stabilizing additives. Very few recycling programs take old gasoline. Most often it must be brought to a hazardous waste site, instead.

²³Many such services contract with cities and counties to handle their waste wood needs, usually at a significant cost savings to landfilling

²⁴Also known as methyl tert-butyl ether, which was added to gasoline in North America for many years, though its use is declining due to health concerns and groundwater contamination

CHEMICALS

There are over 2,000 new chemicals that go on the market each year in the US alone. Contrary to popular belief, only a small percentage of these chemicals are tested for toxicity. None of them are tested for their reactions with each other, despite being very often bound for complex formulas. If it weren't enough that all these chemicals are in your home, when they wind up in a landfill, the fact is that no one has any idea how they'll all react together. It's a grand chemical experiment, really.

Most household chemicals are lumped under the blanket of hazardous household waste. That includes everything from paint to pesticides to laundry detergent. When its used in the manner specified on the label, it is considered okay, but if you're getting rid of a bunch at once, it must be brought to a hazardous waste facility. Very few of these chemicals can be simply put out on the curb.

COMPLEX CONSUMER GOODS

Some of the most vexing and environmentally crucial goods are the complex items that are thrown out each day. Most often, these items can only be recycled by private-sector companies that exist in a few metropolitan areas. These items make up a rather large percentage of the volume of solid waste that ends up in landfills.

Most landfills will accept these items for a fee, and only a few trash haulers will knowingly haul such items away. Many municipalities consider these items to be hazardous waste due to the large proportion of toxic metals and materials that go into their construction. While some manufacturers take these items in return when you purchase a new one, they are not required to do so by law in North America.

Automobiles

Perhaps the largest sub-sector of complex goods that are collected are old cars and trucks. The industry that recycles used automobiles is fully mature and collects vehicles for scrap and parting-out. The disposal of automobile scrap is very often controlled by state, provincial and local laws. Like other complex goods, much of the cost associated with recycling vehicles is the sorting of materials.

Computers and electronics

Just about everyone has computers and electronics to be thrown out sometime. This happens when upgrading to new devices or when they break. Circuit-boards and electronic components are also considered to be hazardous waste by most recyclers and precludes such items from being picked up at the curbside.

There are private programs that collect these good to be repaired and donated to the less fortunate, but many older devices are simply incapable of being repaired. This is partly due to laws that only require manufacturers to carry parts for such devices for seven years after it is no longer sold.

TEXTILES AND CLOTHING

The complex nature of most modern textiles makes their recycling difficult. Carpet, for instance, is an example of a material that can be recycled, but often isn't. For most fibers, anyone wishing to recycle them requires seeking out a private-sector company that takes these items and paying to have it taken away.

The same is true of clothing. Most people in North America have a large collection of clothes that goes mostly unused. These items are sometimes collected as scrap fibers that are sent to far-flung locales such as China. A more personal approach to recycling clothing and other fibers is to directly swap with others. Clothes swapping has caught on in a lot of circles that one might not otherwise consider.

The fibers that are found in mattresses and carpets and couches are more difficult to recycle due to their bulk and complexity. One solution that continues to catch on is the resurgence of quilt-making and patchwork clothing, but curbside pickup remains unlikely. Thrift stores are where most clothes destined for recycling wind up, though the tax breaks for such donations have all but dried up in recent years.

COLLECTION SCHEMES

If goods are to be recycled, someone will have to collect them so they can be properly processed. There are many different ways to handle this, and there is no single way that works best for all communities. Often, the best fit for any recycling program is determined through trial and error.

DIFFERENT COLLECTION LOCATIONS

It has been generally found that if people can put their recycling by the curb, it's much more likely to actually be put out and collected. Other locations include special recycling sites that specialize in gathering the waste that is complicated or less economical for haulers to pick up. Styrofoam (polystyrene) is one example of a materials that is most often taken by specialized recycling centers only. Sometimes businesses will collect certain items that are otherwise difficult to get rid of.

Curbside collection

The most effective recycling method for increasing compliance is curbside recycling. This collection scheme allows households to put out the most often recycled materials so the local government can fund the collection of non-recyclable items and disposal in landfills.

For curbside recycling programs to work, people have to be educated as to what is accepted and how such items will be sorted. Complex programs can be confusing and actually lead to lower rates of recycling. Generally, the more straightforward they are, the more likely people are to participate at the levels that ensure a pure recycled product that can be easily sold on the scrap market.

Industrial collection

Industry also produces a great deal of recyclable waste. This pre-consumer waste is actually recycled at a rather high rate, as a matter of pure economics. If your company had paid for a raw material and was looking at tossing a portion of it out, unused, the odds are pretty good that you'd be looking for something else to do with that product. It turns out, this is very often the case in small and large businesses, alike.

Paper, for instance, paper products are very heavily recycled on the industrial end before it ever makes it to consumers. This is true in a great many industries that you might not even consider. Sometimes this takes the form of giving extra and leftover bits to charity, but this too is a form of recycling or "re-purposing."

Sometimes the waste of industry is collected into new products. For instance, instead of throwing away or even composting the crushed grapes that are left over from wine production, some wineries are selling those grapes to ranchers as feed. New industries have sprung up to use the recycled products that are being generated every day by industry, to everyone's benefit.

Point of sale collection

There are a few countries and sectors that require businesses that sell items take them back for recycling when consumers are done with them, no questions asked. This has been the case in the US with car batteries for several years now, resulting in a recycling rate of well over 90%. Rechargeable batteries are also recycled at many stores that sell them, most notably mobile phone batteries, as well as the phones themselves.

It is expected that legislation requiring other commodities to be taken back by manufacturers such as consumer electronics will be enacted in coming years. However, packaging waste is not typically taken back in nearly the same volume. The exception to this is in states with bottle return laws that are supported financially by beverage manufactures, though they do not run the programs themselves.

DIFFERENT SORTING PROCEDURES

Making recycled waste usable by manufacturers has a great deal to do with the effectiveness and profitability of sorting procedures. Many different schemes have been tried and they all work to varying degrees in different markets.

Unsorted mixed waste

In many areas, especially those where labor costs are relatively low, recyclable materials are sorted from the general trash stream. This has been derided by many as being unacceptably labor-intensive and dangerous for the workers who are exposed to broken glass and organic wastes.

It does, however, take the burden of sorting trash from consumers and often results in far higher total rates of recycling than consumers themselves are usually able to manage.

Mixed recyclables

In many areas, all different types of recycled materials are sorted by consumers into a single recyclable stream. This avoids much of the dangers that an unmixed stream poses to workers. It does, however, rely upon consumers to separate out what they believe may be recyclable materials from the rest of the trash.

Often this is accomplished with the use of a single large bin, often the same size as the trash bin that's offered. Sometimes a separate bin is also

provided for municipal composting, though more often consumers are asked to provide their own container in areas where organic materials are collected.

Semi-sorted

Perhaps the most common type of sorting that is employed in North America is the semi-sorted scheme. Here, all types of glass are separated out from the rest of the recyclables. This usually requires two bins – a small one for the glass and a larger one for everything else. Sometimes paper or cardboard is sorted out, too.

This is a relatively safe type of recycling, though it does still require different colors of glass to be separated out, often by a machine with an optical sensor. Such machines typically sort out broken glass and direct it towards the solid waste stream with only solid bottles being recycled.

Fully self-sorted

Also sometimes called “source separation,” this type of sorting requires the least amount of cleaning and sorting on the part of the collecting agency, but requires consumers to maintain several different bins for each commodity. Typically all types of paper and paperboard are in one bin, one for each color of glass, one for plastics and one for aluminum cans. Since ferrous metals are so easy to separate²⁵, steel and cans are usually accepted along with aluminum. Cardboard is also usually collected separately.

Rates of recycling are often lowest for fully self-sorted systems, since consumers can sometimes get overwhelmed by the amount of organization that's required. However, these systems also tend to deliver the highest quality recyclable material and usually command the highest prices in the marketplace.

Automated sorting facilities

For the majority of common household waste some type of automation is required to economically sort the collected materials. Also known as single stream facilities, these automated plants take mixed recyclables and separate out one type of material at a time. Though the specifics of the procedure vary from one location to another, the general process remains the same.

1. Plastic bags and large paper products are taken out by hand

²⁵With powerful magnets that are often automated or semi-automated

2. Magnets are used to take out magnetic ferrous material such as steel cans
3. Plastics and paper is separated by weight, often by a combination of air pressure and gravity
4. Optical sensors sort different grades of paper
5. Special magnets are used to expel aluminum cans
6. Remaining glass is hand-sorted by color

It is important to note that while such facilities use far less labor, the start-up costs are higher and can present a barrier to establishing recycling programs.

2

BARRIERS TO RECYCLING

Despite only being a part of North American culture since the 1990s, just about everyone knows that recycling is the “right thing to do.” Despite this, not everyone does it, no matter how easy it may be. Moreover, despite the economic benefits to communities, there is not always political or budgetary support for it.

There are also some concerns as to how useful recycling really is from a fiscal or thermodynamic standpoint. Since much of this depends upon the habits of consumers, it can take a long time for a critical mass of people in any community to fully contribute.

Even when materials are well-sorted and collected, a lack of markets for recycled products sometimes leads to perfectly good recycled materials ending up in the landfill for lack of a willing buyer. There are many reasons why recycling simply might not work. Analyzing why it doesn't work can help communities develop programs that do.

ECONOMIC HURDLES

When it comes right down to it, most people will recycle when it makes monetary sense for them to do so. The same is certainly true of businesses and towns. The cost of transport and labor also figures heavily, impacting the collection and the value of recycled materials.

ECONOMIES OF SCALE

Like any other industry, recycling is the most profitable when programs are able to take advantage of the economies of scale. For instance, when a small, rural community begins a recycling program, it takes even more fuel and time to collect all the recyclables as it might in a big city with apartment buildings and a very short distance between pickup.

By the same token, if a new recycling program doesn't have a high level of participation, there are fewer goods to offer on the market at a time. To take advantage of the economies of scale, small recyclers must either team up with other recyclers as a co-op or store the recyclables until they have

enough to offer in the larger marketplace. More often, however, they sell the goods at a lower price to a “middle-man²⁶.”

THE TRUE COST OF RECYCLING

There's a lot more to a recycling program than collecting the goods and selling them off. For instance, there is the challenge of getting an infrastructure in place to even collect recyclable goods from consumers or directly from large producers in a given area. This can be especially problematic in areas where the cost of landfilling has risen to the point where it becomes politically expedient to do something.

The true cost of recycling can also be considered in carbon dioxide. As is increasingly the case, carbon emissions are a type of currency that is actually bought and sold on domestic and world markets. If goods that are shipped from China must be sorted, bundled and shipped back to China to be turned right back into export goods, then it is possible that more carbon has been spent than would have been expended if virgin materials were used.

Consider also the consequence of a solid waste stream that is actually more concentrated without all the paper, organic waste and plastic filler that usually dilutes some of the more toxic chemicals that make their way into landfills. People who have very high rates of recycling tend to have far more toxic trash, per load, than people who don't recycle. Of course, the volume of trash that's thrown out is far less, but the pressure to keep landfill wastes “contained” increases, sometimes to the tune of a great deal of extra money that must be spent on landfill upgrades.

Down-cycling

It is important to consider what recycled materials are turned into on the other end. When something of high value is turned into something of low value, it's called “down-cycling.” Down-cycling often represents a far less efficient use of materials than if they were recycled back into a valuable (or, thought of another way, more desirable) item.

When old rubber-soled shoes are turned into high value inner-tubes or new shoes, there is no overall loss of functionality and the price paid for the recycled items retain value. However, when they're turned into road fill that would otherwise be made of less valuable items, the price that will be paid for such recyclable is kept artificially low. Moreover, virgin materials will continue to be used in high numbers to make new shoes.

²⁶Either a speculative company that purchases from many other small recyclers or a larger city

There are generally two ways to ensure that high-value end-uses for recycled materials.

1. Encourage research and innovation that creates new uses for recycled materials that are in high demand²⁷
2. Create a very high-purity recycling stream that will preferentially be used in higher value end-products, given a market with considerable variation

Ideally, both will be employed to ensure a stable and relatively high price for as many recycled materials as possible in a given community. It is likely that the recycling of one commodity, will wind up subsidizing the recycling of the other materials, depending upon the performance of markets and the distance the goods must travel to get there.

EXTERNALITIES

There are plenty of things that impact the profitability of a recycling program that have little to do with the recycling itself. Perhaps the most obvious example is the price of energy. Currently, the price of all energy is largely dependent upon the current and "future"²⁸ price of oil. As the price of transport goes up, so does the price of running machinery and transport to what are often far-flung markets for recycled materials.

Of course, this can also work in the favor of recycling, as in the case of governmental regulations or land deals that cause the price of sending items to a landfill to increase. Legislation on the local, state, provincial and federal level are all powerful external forces on the recycling industry.

The condition of roads, ports and (especially) rail lines are also very important to the profitability of a recycling program. When relatively inexpensive rail lines are unreliable or too crowded, extra money must be spent on other modes of transport, decreasing the rate of return – sometimes to the point that it becomes cheaper to sell goods for less to a domestic market, assuming one exists.

Other types of externalities are technological, such as changes to packaging or an existing technology that makes it impossible or unprofitable to recycle. It may take the form of a coating on copper wires that cannot be easily removed or a new bottle color that cannot be recycled. Sometimes these "technical externalities" take the form of a threat to other recyclable products

²⁷Specifically, uses that replace even more expensive materials in existing and necessary products

²⁸As determined by the Futures price on global commodity markets, usually in 3 or 6 month increments

such as a double plastic wrapping on a package that gums up automated sorting machines for hours at a time.

LOSSES IN EXTRACTION INDUSTRIES

Every type of recycling has some type of loss, even when everything is working properly. For instance, though aluminum is very highly recyclable and saves a lot of energy, every time it goes through a recycling cycle, as much as 15% of the raw material is lost as ash.

Most recycled products have a similar loss when transitioning from consumer sources. Pre-consumer items also have losses, though they are usually a bit lower, since the materials are often closer to their base form, such as unpainted scrap metal or left-over paper without inks.

TECHNOLOGICAL PROBLEMS

Modern recycling is actually a rather new technology, itself. Though curbside recycling has existed in a few scattered communities since the mid-1970s, recycling didn't really become widespread in North America for nearly 20 years. As such, there are still quite a few technological hurdles that are still being worked out.

CONTAMINATED MATERIALS

The most common problem with getting a quality recycled product, especially from post consumer waste is contamination from other recycled goods and all the bits and bobs that stick to them. This can partly be dealt with by increased education about sorting habits on the part of consumers, but also by innovative technologies that further automate the process.

DISPOSING OF NON-RECYCLABLE WASTE PRODUCTS

When materials go into the recycling stream, a fairly large portion of them end up being pulled out and disposed of in the waste stream anyhow. This usually requires human labor to pull them out, at significant cost, not to mention the cost of sending them to a landfill.

RECYCLING INTO SOMEONE ELSE'S LANDFILL

Since most companies that handle recycling don't own their own landfills, the cost of disposing of non-recyclable waste can sometimes be even higher than sending them directly to the landfill of a waste-hauling company that does own their own landfill. As such, companies that have good deals with local landfills generally have lower operating costs than those that need to send them elsewhere to be disposed of.

WORKER SAFETY

Of concern to anyone who works for a recycling company is the safety of workers in these facilities. Not only are there physical problems such as getting cut on glass shards, but companies that work with older equipment are often called upon to climb around on equipment to pull out plastic bags and other contaminants. Moreover, workers in these plants are sometimes exposed to dangerous chemicals and dangerous organic wastes that can make them sick.

POLITICAL WILLPOWER

Since recycling is a matter of social and community interest, there is a significant role for government to play in keeping recycling a viable option. This is true in small communities where city and county commissioners vote upon these issues from one political cycle to another just as much as the state, provincial and federal politicians who make sweeping legislation that directly or indirectly impacts the profitability of recycling programs.

LONG-TERM POLITICAL SOLUTIONS

As a general rule, the smaller the scope of political influence that is exerted, the more fleeting their support can be. Conversely, federal legislation that influences recycling supports, packaging legislation and landfill regulations have a tremendous impact on the financial health of recycling programs.

Dismantling exclusive union trash contracts

One way that recycling, which is very often a private enterprise, can remain sound is to give them equal footing on the local trash "scene." This can be achieved though discontinuing some of the union trash contracts that are sometimes hostile to recycling schemes that would actually save the taxpayers a significant amount of money. Though this is often very controversial and may upset the balance of power in the often quite lucrative

trash hauling industry, it can be pushed through when the political will is there.

Taxation

No one likes taxes, and this is certainly true in the case of waste. However, it has been shown that the behavior of people over the long-term is most effectively changed when encouragement is coupled with punitive hits that are usually administered through taxation. This may take the form of taxing product manufacturers whose products contribute heavily to the problems with recycling.

Other schemes that have been attempted take aim at consumer habits with a small tax on items that are not able to be recycled. For instance, some cities are considering a small tax on plastic bags in an effort to encourage people to bring their own reusable bags. This has proven more effective than simply giving away such bags and encouraging their use.

Increased regulation

One of the most common types of regulation that has been proposed is the "Extended Producer Responsibility" scheme. Here, companies are responsible for making sure what they sell is recyclable and uses as little packaging as possible. In some Canadian provinces, this has been set up, one commodity at a time. In the EU, all computer manufacturers are required to see that the machines they sell are responsibly managed at the end of their useful life.

MORE PALATABLE LEGISLATIVE ACTIONS

Not all government actions have to be quite so unpopular. There are quite a few "carrot" approaches that have wide-based popular support. Many of these ideas have been tried with considerable success over the long-term, though it sometimes takes quite awhile for them to have measurable impact.

Package labeling

One of the most successful ways to let people know just what is and isn't recyclable is to label packages. Not everyone is an expert in packaging types and it can be rather confusing for people to quickly decide what to do with something. In frustration, many recyclable items are thrown away because people can't figure out what bin they should go in.

The plastic labeling program (in the form of the "resin codes" that have existed since the late 1980s) has been not only successful in getting people to recycle the plastics that are currently able to be handled by municipal recycling programs.

It also encourages people to lobby their local governments and waste-haulers to accept the other types or at least make it a matter of public knowledge what people can do with these materials themselves. Styrofoam packing peanuts, for instance, are generally not recyclable, but many local governments have put up websites that make it easier for people to find local businesses that can use them. By connecting consumers with users, the local landfills are spared this input and local business is supported, with the side-benefit of encouraging community.

Decreased garbage pickup services

One method some cities and towns have found really works to encourage consumer recycling is to decrease the frequency of garbage pickups while keeping the interval between recycling pickups or, at least, keeping it stable. In communities where trash is picked up every other week while recyclables are picked up twice as often recycling rates tend to go up significantly across all the different segments of recycled items.

Deposits and bottle bills

Consumers can also be rewarded for bringing in their cans and bottles, as has been done in many states. The "bottle bill" that was started on a state-wide level in Oregon during the 1970s has served as a model for other states who wish to increase recycling rates of these commodities. While glass may not save a great deal of money as a recycled product, it certainly saves a lot of transport cost and landfill space when it is recycled. As a side benefit, it unofficially recruits the homeless population as amateur trash sorters, five or ten cents at a time.

Taking this one step further are grocery stores that sell milk in glass bottles with a deposit. Once collected, the consumer gets their deposit money back, the bottle is sent back to the dairy, sterilized and refilled, starting the process anew. Best of all, nothing has to be thrown away save the plastic top.

Reuse schemes tend to be local or even personal in nature, since few states are willing to require them. However, with public pressure, such legislation can become the law of the land.

Eliminating the plastic bag

Plastic bags are the bane of recyclers. Though they can be recycled in some factories, they far more often wind up in recycling bins, trash cans and tree limbs. While some communities have taken a taxation approach to eliminating plastic bag usage, another way to eliminate plastic bags is to ban them altogether.

Usually when this is done, hardship waivers are granted to retailers who can convince someone in city hall that they can't make money without them. In Ireland, as a result of a ban on plastic bags, their use went down by over 90% in a very short period of time.

Hazardous material bans

One of the most cumbersome types of materials to recycle are complex and hazardous materials. More often, these recyclables are collected at odd times at special sites set up to receive them.

It has been shown that recycling rates go up significantly when it's as easy to recycle as it is to throw them away. Picking up hazardous waste at the curbside, though a liability concern for recyclers, has a significant impact on the percentage of these metals and chemicals that avoid a landfill burial. Some cities have tried this on a trial basis, picking them up in separate bins or once a month (instead of weekly).

3

COMPOSTING ORGANIC WASTES

Though not strictly considered recycling by some, composting is, in fact, the world's oldest and most reliable form of recycling. Not only is it useful on-site, but those who reliably use their composted waste as garden fertilizer and soil builder – especially important for organic gardeners.

DEFINING THE ORGANIC WASTE PROBLEM

Most organic wastes are included in what the EPA calls, “non-product” waste. The good news is that this has actually decreased in North America since the late 1990s, largely due to increased rates of leaving lawn-clippings on the lawn and home composting. However, there's still millions of pounds that enter landfills every day.

POLLUTION AND METHANE GENERATION

Strangely enough, organic wastes are actually one of the biggest contributors to landfill instability and air pollution. There are some landfills that attempt to oxygenate their organic wastes in an effort to generate relatively inert nitrogen instead of the powerful greenhouse gas methane.

These landfills can be capped or the organic matter can be composted under aerobic conditions in just about any back yard. There have been a few schemes to use the methane produced by these explosively powerful sources to run manufacturing plants or even to power electricity generating turbines for consumer use.

But the vast majority of these landfills are major contributors to greenhouse gas emissions that are regulated under the terms of climate change treaties. Therefore, they've become more than an explosion hazard and a stinky reminder of days bygone – they're a liability as far as meeting international treaty agreements. Even if the United States as a nation doesn't ratify the Kyoto Protocol, hundreds of individual cities and states have done so themselves.

LANDFILL SPACE

While organic matter does get smaller as it decomposes, it can take up a considerable bulk when it's first put in. Since decomposition in the absence of oxygen takes many times longer (over 100 times longer in some circumstances²⁹), this process is much slower than it would be in the case of a well-turned compost pile.

It is thought that over 30% of landfill space in North America is made up of this very slowly decomposing material. Not only is it something of a delayed reaction problem, since it will keep belching out methane for hundreds of years, but the grounds that have become the home of parks and new housing developments will certainly settle and sink over time. It is likely that the mounds of landfills that exist now will become the sink-holes of tomorrow.

SAVING MONEY

Of course, landfill space is measured by volume. Cities and consumers pay to get rid of their trash according to how much space it takes up, not how much it weighs. This makes sense given that the cost is not in supporting the weight of the trash, but digging big enough pits for it to all fit in.

Consider how far a 30% savings in a municipal waste hauling budget would go in an era of ever-shrinking budgets for even basic services. Even before federal governments clamped down on just where landfills could be placed, the cost of digging up new landfill space had already begun to exceed that which people were generally willing to pay. No one wants a landfill next to their land, and very few communities have ponied up to store the stuff, so the cost of dumping gets higher every year.

If even half of the compostable materials were removed from the trash stream (and this seems a very attainable goal in both urban and rural areas with municipal composting), this 15% savings in the trash bill could represent millions of dollars of savings in even moderately large cities.

HOME COMPOSTING

Of course, few cities are running municipal composting sites, as of the late-'aughts, so if you're going to keep your own organic wastes out of the trash stream, you'll have to do it yourself. Thankfully, this is not very

²⁹The metabolic pathways of anaerobic micro-organisms that perform decomposition are far less efficient than their aerobic counterparts that developed billions of years later, as the Earth developed an oxygenated atmosphere

difficult to do. It is little more work than simply putting your organic waste into a separate bucket. Instead of taking this bucket out to the curb, you dump it in a pile or bin in your yard.

It is important to note that sending organic waste down the garbage disposal is NOT composting. In fact, this process also contributes to pollution by injecting what could be thought of as fertilizer into local water supplies. Here they encourage algal blooms that rob oxygen from the water, often resulting in fish kills and dead zones, even in river systems. Larger chunks of organic matter are collected and, most often, sent to a landfill.

THE BASIC PRINCIPLES OF HOME COMPOSTING

Though entire books have been written on the topic, composting at home is actually quite simple – the rest of it is just gravy. It is increasingly common for those who garden to manage their own compost piles, and many have been doing it for many years.

A well-managed compost pile doesn't smell of anything more than soil. Again, the production of sulfuric compounds and methane that are the most offensive are a result of a pile that has "gone anaerobic." It may seem counter-intuitive to some, but giving a pile more air actually keeps it from smelling. And, by more air, just giving it a turn every few week is plenty.

The pile should also be kept reasonably moist during particularly dry weather and from being sodden during the wet season. The process relies upon the action of animals, no matter how small they may be, and the rate increases and decreases depending upon conditions. As such, the warmer it is, the faster the process is.

If you'll be tossing weeds and their seeds into a compost pile, it will have to be far more carefully maintained to make sure it gets hot enough on the inside to kill them. Like cooking meat, you need to make sure the inside of the pile gets up to about 180F until it's safe to prevent the spread of weeds in your compost. This may seem like a very high temperature for a bunch of scraps tossed in a pile, but a compost heap that is regularly turned and maintained can easily reach these temperatures.

But for most homeowners looking to make some of their own fertilizer and keep their organic scraps out of the solid waste stream, a less intensive approach works just fine.

The basic approach goes something like this:

1. One small, covered container by the sink to make putting scraps in handy
2. One larger, covered bucket by the back door

3. A pile in the back yard loosely covered by a tarp or a composting bucket that allows for easy turning or removal of finished compost at the bottom

You can include all manner of kitchen scraps, yard debris, paper towels and other small bits of paper such as newsprint and egg cartons. Just about anything that is made from something that can be found in nature can be recycled – some things just take a little longer than others. Shells, wood and cotton products take a long time, while food and less dense forms of paper decompose very quickly.

The general compositional rule of thumb is to maintain a 1:1 carbon to nitrogen ratio. This simply means you put as much dry, “brown” stuff in as wet, “green” stuff. Most anything (other than fruit) that comes from a tree is going to be “brown.” Nearly all vegetable matter is considered “green.” This is a general guideline, and problems don't often occur unless the balance is very far off. If you find yourself throwing out far more kitchen scraps than leaves, add in some paper egg-cartons that would otherwise go into the waste stream.

It is important to note that there are some wastes that should not be added to a compost pile. Animal waste is one example, as it can carry pathogens that are not destroyed by a well-heated pile, such as hook worms. One should also be careful not to add any meat scraps, for much the same reason as well as the likelihood that such a pile will attract wild animals.

FINDING THE SPACE

For any homeowner, it's easy to find a spot in the backyard to put a compost pile. Often it is located in a corner or under a tree. Most households only need a pile a few feet (about a meter) in diameter to get a good results. Those who don't own their own yards may find this a bit more difficult. In such situations, a free-standing barrel that can simply be flipped over is often a good substitute that allows the waste to be fully contained.

HOME GARDEN FERTILIZER

You'll know the compost is done when it looks like dirt. You can simply add it to flower and vegetable beds as a much and let the worms dig it in or dig it in yourself. It adds not only a good spread of nutrients, but over time also adds organic matter to the soil that will make it easier to work³⁰ over the long-term.

³⁰This is what horticulturalists call a “friable” soil

It's already a balanced fertilizer with relatively low nutrient value (compared to petrol-chemically derived fertilizers), so you don't have to worry about adding too much. The resultant soil will also have a higher "buffering capacity," which means it will be less likely to become too acidic or alkaline, no matter what else you add to it.

MUNICIPAL COMPOSTING

Some cities collect organic matter and yard debris from the curbside as part of a municipal composting program. Though this is a relatively new program in most areas, the resulting compost is either used as part of the parks program to fertilize flower beds and green-spaces or made freely available to citizens who are willing to haul it away from the composting site. Sometimes, it's even sold in bags to help offset the costs of the program. Regardless, there are significant cost-savings to a city that would otherwise have to pay to send that matter to the landfill.

REQUIRED RESTAURANT COMPOSTING

Often when cities decide to begin a composting program, they start with restaurants, which are very likely to be the largest contributors of organic matter to the local landfills. This is either accomplished by making compliance compulsory, according to city ordinance or by simply providing the bins for free.

Either way, compliance rates are often very high, since it's usually a very simple thing for restaurants to do since they're often already separating out compostable materials, anyhow. The amount of scraps from even a small restaurant can be quite significant. By composting instead of simply tossing such scraps out, attacks by animals and a curtain of flies can also be avoided.

Sometimes this also extends to a collection scheme for used fry oil that can then be turned into recycled bio-diesel. The rates of collection for this commodity are often a bit lower since many restaurants can make a small side income by selling it directly to bio-diesel users as automobile fuel or home heating oil.

APARTMENT COMPOSTING

Many apartment dwellers who have to place to make their own piles or bins for composting are able to take advantage of municipal composting programs by depositing their kitchen scraps instead of simply dumping them down

trash compactors or into the rubbish bin. Often, many apartments will share a single composting bin that can be efficiently picked up by recycling haulers.

ON-FARM COMPOSTING

One major contributor to scrap waste are farms, ranches and nurseries. All these agricultural enterprises create a massive amount of organic materials, whether they be "green" or "brown" matter. Since tend to be outside the rage of many municipal composting programs, it is more often up to them to collect, compost and use their own organic matter.

Since this is, in fact, their business, many farms are already collecting organic wastes for processing anyhow. Making sure the final product is a high-quality compost is also far more important.

LARGE SCALE MANAGEMENT

The volumes of materials that most farms are dealing with is rather large – nearly on the same scale as an entire municipal program in many cases. As such, the management of such large volumes cannot be turned with a single barrel or spade. More often a rather large span of land is required to keep the compost confined into manageable piles.

It is common to see long rows of compost being maintained next to or even within fields as strips that can be turned with a tractor or all-terrain vehicle with a plow mounted on the front. It is also important for such piles to be processed as quickly as possible, so very regular turning (and sometimes watering) is also important for a nice, quick turn-around.

EMPLOYEE TRAINING

For an on-farm composting program to work reasonably well, employees must be trained as to the accepted inputs and the theory behind the composting. As any other program on the farm (or any other business, for that matter), a well-trained workforce is essential for the success of the program.

As a general rule, the system is often best worked out beforehand and broken down into simple steps that work best for each crop. Supervisors will usually direct the work of those under them on a daily basis. A simple plan might look something like this:

1. Separate woody material from vegetable matter and chip up the former before adding to the pile

2. Make a list of materials that are not to be composted but, burned instead.
3. Old soil and potting media can be part of the recycled material – be sure to check with a supervisor to find out which soils are suitable for direct reuse and which should go into the composting program.
4. Someone should be given the task of monitoring the compost a setting a schedule for turning

RELIABLY ELIMINATING WEED SEED AND DISEASE

It is very important on a farm to make sure weed seeds and disease organisms don't turn the compost into a carrier for future problems. This can be done best by carefully monitoring input materials for disease. Often, these materials should be burned first before being added to the compost.

Weed seeds are more often able to be destroyed by simply making sure the pile gets hot enough for long enough to "cook" them. This means that careful monitoring of a pile should also include a log book and a regular temperature probe of the piles. Good mixing is also important to make sure the whole pile spends enough time on the interior to make sure it's cooked evenly through.

4

A POSSIBLE FUTURE PLAN FOR RECYCLING

It should be clear by now that plans that increase the rates of recycling will certainly reduce waste, pollution and energy use throughout North America. Therefore, a future plan for recycling as much waste as possible and minimizing the contribution to landfills relies upon all the "three-Rs" of the sustainability mantra:

1. Reduce by consuming less wasteful packaging and then only that which can be recycled into high-value items
2. Reuse as many items as many times as possible before they enter the recycling chain
3. Recycle everything you can and throw as little into the trash can as possible

The lessons of the last 30 years of recycling, as well as a bit of psychology and common sense can help guide laws, policies and programs that will benefit (and hopefully profit) everyone involved.

FACTORS THAT INCREASE RECYCLING RATES

The solid waste stream is very regularly monitored in most communities to get an idea of how much of each recyclable materials is tossed out and how much is recycled. From this data we know that rates of compliance for various materials vary widely. We also know that this changes over time, according to circumstance and by community.

Simple changes that can encourage a distribution of the effort to each and every consumer are the most valuable and expensive or punitive approaches are the least favorable. However, sometimes a less favorable option is the only one available.

HIGH PRICES FOR RAW MATERIALS

One way to encourage recycling is to impress upon local governments and trash haulers just how profitable recycling can be. This is best done by ensuring that the rates paid for recycled materials are high, while keeping the cost of such materials low enough that demand will continue to be high. This is something of a tightrope, but not unlike the very same one that any commodity goes through in a free market.

Of course, the freedom of any market is a matter of debate, and there are plenty of reasons why such markets are interfered with on both the supply and demand sides. This can take the form of trade and import duties, subsidies, governmental programs or “sweetheart” deals.

However, the most important part of securing high prices for a recycled commodity is the continued purchasing preference of consumers who demand recycled products. Producers can also increase the likelihood of manufacturers demand with careful sorting that leads to a superior raw material.

ADHERENCE TO INTERNATIONAL TREATIES

There are outside forces that are at play in the marketplace and international treaties that seek to limit pollution or greenhouse gas emissions have proven very useful in increasing the pressure on both small and large-scale governments to focus more political capital on recycling under their jurisdiction by any means necessary. Even when treaties are not adhered to at the national level, as in the case of the US and the Kyoto treaty, individual cities, provinces and states can form binding arrangements that encourage recycling as one of the many options for meeting treaty obligations.

INCREASED TRASH HAULING COSTS

If there was ever anything that got a city councilperson to act it is saving some money in the budget. This is true for consumers as well. While it is rarely advantageous to raise the rates of any basic service, most people understand the pressures that are at work to raise the rates for trash haulers and the cities that employ them.

It has been shown that when the price of tossing out the trash increases, people recycle more – it's that simple. The same is indirectly true when landfills increase the rates they charge haulers to dump there.

ECONOMIC RECESSION

Though the specter of an economic downturn doesn't make anyone happy, it is a fact that when times are tough, people are much more careful with the things they buy and what they throw away. Poor people are much more likely to reduce and reuse. When putting out the recycling is free and hauling away the trash costs money, rates of recycling skyrocket among the less prosperous.

It can be argued that part of the "disposable mindset" in North America is the result of the relative prosperity that has been enjoyed since the 1950s. As the standard of living has increased, so has the pressure on landfills to hold all the packages that the trappings of prosperity came in.

While no one is advocating some sort of misguided path towards economic hardship, if such an event does take place (as seems to be the case from time to time), merchants and recyclers can be sensitive to this and do their part to save their customers money and save waste from landfills.

DECLINING ENERGY STOCKS

Anyone who has studied macro-economics knows that there is one commodity that underlies every aspect of the economy in one way or another and that's energy. To put a finer point on it, energy is oil. Renewable resources and nuclear power, though a hopeful future for the energy sector, still only produces a very small percentage of the total power in North America and essentially none of the transport power.

If the oil companies themselves are to be believed, there is an energy-poor future facing us in the next 50 years. To avoid being left to drown in our own waste, it's best to prepare for this eventuality by getting our waste under control, now.

Generally speaking, as the price of oil increases, the cost of producing virgin materials increases faster than the cost of using recycled materials. The price of transporting waste to landfills also goes up considerably, making it a public priority to encourage recycling at all levels.

WAYS TO IMPROVE THE SYSTEM

New and old recycling programs, alike, are in a constant state of improvement. It is more than likely that recycling systems will continue to make improvements from a technological standpoint as well as conserving more energy in coming years.

CLOSING THE RECYCLING LOOP AT THE MANUFACTURING LEVEL

One way to ensure that even more material is recycled is to increase the amount of these products that are recycled in the pre-consumer waste stream. The paper industry is perhaps the largest player in this market now, with most paper mills already recycling a very large portion of their waste products into new paper.

However, other industries are also ripe for increases in the amount of waste materials that can be recycled by their own factories as well as being shipped off to other, related industries. Textiles, metals, rubber and plastics are all industries that can easily show improvements in the rate of pre-consumer waste that can be recycled.

While the monetary incentives for doing so are a strong incentive for recycling, trade unions, governments and other non-governmental lobbies are all in a position to encourage this practice.

DOMESTIC RECYCLING PROGRAMS

Saving energy in the recycling process can be hugely increased by encouraging fully domestic use of recycled products. As it is, a very large volume of recycled materials are sent to Asia for processing and re-manufacturing. Such long trips, use a great deal of fuel, and seriously cut into the ultimate energy savings of recycled products, especially when the recycled products are sent back to North America for sale.

This can be addressed through investment in domestic programs by the market as well as tax credits and other types of governmental assistance. It is also likely that further increases in the cost of energy will cut into the profits that are currently enjoyed by this practice. An increase in the wages of people living in those countries are also seen as a way to narrow the gap, though such sweeping social changes are not expected to be seen anytime soon.

ELIMINATING DUMPSTERS IN URBAN AREAS

One controversial system that has been employed in urban areas with some success is the elimination of dumpsters. This forces the owners of these dumpsters to more carefully examine their waste streams and focuses on constant pick-up by recyclers.

The added advantage of such a system is the beautification of public areas, though some argue that it actually contributes to unsightly waste and litter when the collection bags are torn apart before they can be picked up.

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PRACTICAL ADVICE FOR INCREASED RECYCLING

So, what can you do about it? As follows are tips and tricks that will help you increase your own rates of recycling while setting a good example for others. You might even become something of an expert.

RECYCLING AT HOME

It should come as no surprise that much of the best recycling practices start well before you decide whether to use the trash or your recycling bins. Recycling in the home has the potential to account for a very significant proportion of the total amount of recycled materials that are available to manufacturers, due to the vast number of households that are currently throwing away perfectly good recyclables.

YOUR PURCHASE DECISIONS

The first place you can start is by making a conscious effort to purchase less waste. You certainly do have a choice, whether it takes the form of choosing items that are durable and reusable or, simply choosing to support to purchase materials that are made from recycled products.

Low or no waste packaging

Just because manufacturers increasingly rely upon larger and more intensive packaging doesn't mean you have to buy it. In fact, manufacturers are beginning to realize that they can save money by saving on packaging waste, too.

Consider computer software. This product is inherently made of data, most commonly proffered in the form of a CD or DVD. However, in an effort to draw eyes to a store shelf, such products often come in rather large boxes and cases that cannot be recycled by most municipal programs. You can

choose to purchase software that comes without such boxes or even download the software³¹, avoiding the non-recyclable media entirely.

But that's just one example. There are many others. For instance, since the 1970s, cooperative groceries have encouraged people to bring their own containers to the store and package what they need from communal bins. This has caught on to such an extent that more conventional groceries and supermarkets are also increasingly using the bin scheme to deliver products that people purchase on a very regular basis.

Not only does this allow consumers to bring their own containers to the grocery, but also encourages the re-use and re-appropriation of commonly used containers such as old yogurt tubs and jars that may not be easily recyclable.

You can even make a difference by choosing to bring your own bag to the store to avoid being given a plastic bag. Even paper bags can be brought back to the store, sometimes for a small discount or rebate for each bag saved.

Choosing easily recycled containers

When you do need to buy something in a container, such as beverages or canned goods, you can choose to purchase items that come in containers that you know your local recycler can use. For instance, when given the choice between a paper or Styrofoam³² cup, you can choose the former.

This also includes spending your money at shops and restaurants that support recycling with their use of recyclable materials. You can sometimes request that your favorite shopping spots make changes that support containers that are more favorable to recycling streams.

Buying recycled products

There would be no recycling industry if no one was willing to purchase recycled products. This is the best way to close the "recycling loop" on the consumer end. Such purchases usually offer a choice and one that is almost always printed on the label. In fact, recycled products very often come with packaging that is also recycled or, at least, minimized.

This includes both the packaging that these items come in and the items themselves. This is evident in the case of dog toys. Since dogs really don't

³¹A trend that has gained a great deal of support throughout the '80s, as well as the notions of "leasing" software, choosing open-source software or using web-based applications

³²Also known as poly-styrene

care what color an item is, they can use rubber and plastic that come from less desirable mixed color streams. Another example might be choosing to purchase a toothbrush that has been made from recycled toothbrushes and natural fibers.

Many products that are commonly offered as recyclable also offer a choice between those made from exclusively post-consumer waste and those that utilize materials from both pre- and post-consumer materials. Toilet paper is a good example. Since both types of recycling are very important, it makes little difference which you choose – it only depends upon which type of recycling you want to support with your purchases.

REUSING ITEMS

Every time you choose to re-use a container, you are actually saving even more material and energy than if you had simply chucked it in the appropriate recycling bin. It also just happens to be the easiest way to make a big difference in the volume of virgin materials that your purchase. This is especially true when you're dealing with a product that is not offered as a recycled alternative.

Items can be re-used for their original purpose or you can find a new use. This takes a bit of creativity, but the possibilities are endless. It can be as simple as using an old sauce jar to hold marbles or beans. You can also use that same jar to make sprouts or shake up gravy or any number of things.

There are only a very few types of containers that you should never re-use, under any circumstances. Pesticide bottles are one example. Even putting new pesticides in such a container is dangerous, unless it's the very same product – interactions between chemicals is a very dangerous thing to play around with. Household chemical containers should also be recycled rather than reused.

UPCYCLING

Related to the more simple reuse of items, this is the practice of taking an old or disused item and turning into a new, value-added product. This allows an enterprising person with creativity to turn complex or otherwise unrecyclable items into works of art, new clothes or something entirely new. The key is that whatever the new item that's produced, it should be worth far more than the individual inputs.

Upcycling is the basis for DIY manufacturing that has recently arisen as a type of home-based business for many people. Jewellery is one of the most common items that is made of many disparate old items such as bottle caps,

scrabble tiles and subway tokens, to name a few. However, any number of complex items can be manufactured from seemingly disparate things.

MAKING RECYCLING PROFITABLE FOR EVERYONE

Much of the criticism of recycling has hinged on the instances where recycling is definitely not the most economical option. For those who rely strictly on the free-market model of interpretation, the benefit of forced recycling programs is not always advantageous to all parties involved.

However, people who adhere to this model would be well-advised to consider just how level the playing field really is. The price paid for sending items to the landfill is actually quite a bit higher if the true cost of environmental degradation, carbon dioxide emissions and natural resource depletion is taken fully into account. When these environmental externalities are properly applied, the cost of recycling is almost always lower.

That said, we don't live in that world, so for recycling to be the more attractive option requires that everyone involved make a profit, since only a small percentage of people can be expected to pay to do the right thing on principle alone. This means that government regulations that require the taxpayer to foot a bill to support a recycling scheme that has no hope of ever being profitable on its own is a waste of money.

In theory, a high environmental cost and an increasing actual cost should be enough to encourage the innovation that will make the true costs fall into line. This often happens, but sometimes public pressure steps in. Clearly, the way to make technologies that are not yet ripe pay off is to invest in research. Otherwise, preferentially favoring industries that do not have such challenges is the best stop-gap measure, in the meanwhile.

Consider the use of disposable diapers. These are prohibitively expensive to recycle, even though their constituent components of plastic, polyester and cotton are very recyclable on their own. Until a better way to recycle these materials can be found, the use of reusable cloth diapers is a far better choice than forcing people to participate in an ill-conceived recycling program that must be subsidized by local governments.

Proper sorting

From the standpoint of existing industries, the most important thing that can be done is to make sure everything is sorted out correctly. This means keeping things separate on your end. This is not always easy, since many goods look very similar. For instance, bio-degradable plastics can make their way into the recycling stream, despite being labeled with a different common resin code and capable of ruining an entire batch of melted down plastic.

On an institutional level, making sure that sorting facilities are in good order, including worker training and conditions, is important for making sure that the highest possible efficiency is observed in recycling plants. For municipalities that are looking to increase the rate of compliance or the quality of a given recycled commodity, there must be a public education campaign.

Furthermore, in areas where the recycling habits of the population are already mapped out, the recycling program can be adjusted to best suit the habits of a given community. In some areas, the best quality of sorting is one at the home that fully sorts items out at the curb. In other areas, requiring that much effort on the part of the public will certainly damn the process into obscurity. Working within the efforts of your local system will ensure that recycling makes a better profit from everyone involved.

What is clean?

Part of doing a good job with cleaning up recycled products is making sure what you put in the bin is clean. This means there are no bits of food still sticking to the items tossed into a vast plastics plant. Other items that should be carefully removed from recyclables include waste, meat products, bones, scraps, excrement and other bio-matter. There is usually no need to rinse most beverage containers.

WHAT TO DO WITH HAZARDOUS WASTE

Hazardous waste collection generally lags behind the convenient, curb-side schemes that most recycling programs use for non-hazardous recyclable items. However, some rather common items are on the list of items that consumers are required to do their own legwork to get rid of in a safe and effective manner. A partial list of the everyday items that are usually considered hazardous waste might include

- all types of light bulbs and tubes
- household paint
- cleaning chemicals
- pesticides
- health and beauty products
- anti-freeze
- rat poison
- herbicides
- consumer electronics
- carpets
- drain cleaner
- household bleach and laundry soap

- motor oil

Such items are very dangerous in both a landfill and in the water supply. Increasing the recycling rates of each commodity may require regular hazardous drives from the curbside. Many communities have designated regular curb-side pickup dates that allow people time to gather the chemicals in question.

RECYCLING AT THE OFFICE

Whether you're an employer or an employee, you can make changes to your work life that make it easier to recycle while you're at the office or when other people use your goods and services.

PAPER PROBLEMS

In most places of employment, paper waste is, by far, the largest contribution to the solid waste stream. The figures are staggering. Setting up a recycling program in your office requires that you make it as simple as possible to recycle. Usually this means putting out a very large number of collection bins and arranging for a recycling bin to collect it all together.

It's also important to make sure the bins are regularly collected on a regular enough basis so people aren't discouraged. If you use a cleaning staff, they must be instructed as to how you want to run your recycling program. That sometimes means checking up on them to make sure the recyclables are not simply being tossed into the regular waste after your other employees have gone to all the bother to separate it.

Choosing and using recycled paper

You can make a big difference in the demand for recycled materials by making it a standing company policy to always purchase recycled paper. Paper products from both recycled and virgin sources are virtually indistinguishable in either a printer or to the naked eye. Choose a grade that isn't too much more expensive to purchase and meets all the requirements of your end-users.

If documents that are being printed are very important, you might want to consider having a higher grade of recycled paper on hand, in an effort to make sure it withstands the test of time and soaks up the inks properly.

Using electrons instead of paper

Of course, avoiding the use of paper altogether is the most important way to reduce the contribution your office makes to the mountains of paper that are tossed away each workday in North America. There are several ideas to reduce this waste that, when taken in tandem, can increase paper recycling rates as well as cut expensive paper use by as much as 90%.

One way to do this is to employ good quality computer software that is very regularly backed up to both a local and a remote backup source. Giving people wireless access to such a data base with hand-held or mobile devices can also reduce paper use, when they can take the data with them.

Another useful way to curb paper use is to lay down some guidelines for how you'd like paper use to be addressed. As a general rule, it's a good idea to give department heads latitude in deciding how your goals will be best implemented on a day-to-day level.

The use of technology has the potential to eliminate the use of many recyclable products, but like the "paperless office," can also increase the reliance upon material products if not implemented properly.

TECHNOLOGY

One thing about technology is that it's always old before it is no longer useful. Therefore, the replacement schedules that businesses run on also require them to consider how the various technologies they use will be disposed of.

This is very often addressed at the time of purchase in the form of a lifetime use and maintenance schedule that includes a planned "retirement date" for each major equipment purchase. Maintenance is important, as is choosing technology that can be updated for many years to come.

New life for old computers

When it comes time to replace old computers, instead of giving them to the hazardous waste collection, try finding new owners who can use them. This can be done by giving them away to charity, selling them at low cost to employees for their children or finding new, less critical uses for them in your company.

GARBAGE AUDIT

Perhaps the most significant step towards getting your waste habits under control at the workplace is to conduct a garbage audit. Some cities provide this service. More likely, you'll be doing this yourself or hiring an outside agency. Check with your local recycling program to see if there is a grant that will cover the cost of a third party audit.

SETTING UP A RECYCLING PROGRAM

If you haven't done so yet, set up a recycling program and teach people how to use it. If bins are conveniently located so there is little or no effort on the part of your employees, rates are generally high. The same is true of putting bins in the lunchroom for organic waste, metal, paper and plastic.

Education is also very important, but mustn't be presented as a chore. Get right to the point in meetings and memos as to precisely what goals you want fulfilled and back this up with good data. Be sure there are instructions posted nearby to keep people from contaminating your own waste stream.

CHANGING PRODUCTS AND PROCESSES TO BE RECYCLING FRIENDLY

The waste that's generated by your workers isn't the only type of waste that can be eliminated. If your company produces a tangible product, it is likely that your products can be made more ecologically sound, in part, by making them more likely to be recycled or reused themselves.

One may also have an impact on the energetics of your raw materials by carefully choosing the source materials. They would ideally be produced nearby from renewable materials, not be so complicated that they couldn't be easily recycled, durable enough to require less regular replacement.