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Waste Prevention Saves Energy[1]

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TRASH TROUBLE

Garbage, waste, rubbish, trash--we, the people, are producing too much of it. On the average, a Floridian generates 8.3 pounds of solid waste every day, 4.7 pounds more than the national average estimated by the Environmental Protection Agency (EPA) (State of Florida Department of Environmental Regulation, 1991). The municipal solid waste (MSW) found in the home and office garbage can is a product of natural resources used to manufacture it. This includes energy resources both as a base materials (feedstock) and as power for processing and transportation. The mining, refining and consumption of these energy resources creates a variety of pollutants. Given this information, it is easy to see how MSW is a triple whammy.

1. natural resources are used up, decreasing the quantity of these irreplaceable materials,

2. energy is consumed, leaving less for the future while creating more pollutants and increasing the potential for global climatic change, and

3. efforts at MSW disposal are contaminating the environment in which we live.

There are three major methods of dealing with the solid wastes generated: landfills, incineration and recycling. Each method has capacity limitations (Table 1). Therefore, the best means of subduing the problems associated with MSW is to reduce the amount of MSW created.

THE FIRST LINE OF DEFENSE

Source reduction, also called waste minimization, is an abatement of waste propagation, a decrease in the amount of garbage generated per person per day. It is pollution prevention activities of manufacturers and consumers aimed at reducing the toxicity or quantity of products before they are purchased. This factsheet discusses opportunities for consumer waste **prevention**.

Source reduction decreases:

1. the land area in the state that must be committed to landfills,

2. the rate of natural resource depletion, and

3. the quantity of pollutants generated during commodity production, use and disposal.

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When fewer products are manufactured, less energy is consumed to make and transport them and ultimately, less energy ends up in the garbage can. Some waste minimizing strategies are listed in Table 2.

EXPENDING ENERGY

In 1984, people in the United States discarded 59.6 billion pounds of paper packaging (Selke, 1990). Approximately 660 million trees for paper pulp were harvested and the energy equivalent to 17 billion gallons of gasoline was consumed in the processing and transportation of this paper packaging. Seventeen billion gallons of gasoline could keep the 60-watt light bulb on your back porch lit for over 400 million years.

In 1987, 4.4 billion pounds of plastic film were thrown away in the United States (Selke, 1990). The production of this plastic consumed the energy equivalent of 2.8 billion gallons of gasoline. This same energy could have run your 20-cubic foot refrigerator continuously for over 5 million years.

If source reduction measures were used to decrease the amount of plastic and paper packaging used by 10 percent, 6.4 billion pounds of MSW would be removed from the waste stream and the energy equivalent of almost 2.0 billion gallons of gasoline would be conserved. Two billion gallons of gasoline is greater than the energy it takes to operate your television for 170 billion hours. One hundred and seventy billion hours is over 650 million years of Star Trek reruns.

OPERATION SOURCE REDUCTION

Source reduction is about making choices 365 days a year at home, at work, in the car, and at the store. Any reduction in the amount of MSW generated by one individual is a successful waste minimizing mission. The following provides descriptions of a few source reducing game plans that illustrate the enormous energy and resource savings and environmental benefits that can accrue from the actions of concerned citizens.

Juice: Buy the Gallon

A household of four people can drink more than 45 gallons of Florida orange juice in one year, if each person drinks a typical 4-ounce serving with breakfast every morning. Unless this orange juice comes from freshly squeezed, backyard oranges, it must be purchased in some type of container at the grocery store.

Orange juice can be purchased in 16-oz, 32-oz, and 64-oz wax-coated paper containers. The selection of container size significantly affects the energy and environmental impact of the purchase (Table 3). Buying 45 gallons of orange juice during the year in 64-oz containers costs $272, while buying 45 gallons of orange juice in 16-oz containers costs $433. Therefore, buying orange juice in bulk can save $160 annually. In addition, since bulk buying reduces the quantity of containers used per fluid ounce, buying orange juice in bulk can save enough energy to power the hall night-light for 490 nights (Table 4).

The Sanctioned Sack Lunch

A sack lunch sandwich can be packaged in a variety of ways: aluminum foil, a ziptop baggie, or a plastic sandwich box. The energy required to make these containers differs depending upon the material type and the amount of recycled fibers used (Table 5).

Generally, when packing lunches using aluminum foil or baggies, new foil or a new baggie is used every day. By comparison, plastic sandwich boxes can be reused repeatedly. When a sandwich is packaged in a plastic sandwich box instead of aluminum foil or plastic baggies, over 80 percent of the energy used for sandwich containers is saved. This can lead to big savings over the course of a school year. There are approximately 185 days in a school year. If one student's sandwich for lunch is packed in a plastic box instead of a ziptop baggie, the family saves $15 on sandwich wrappers, because one plastic box can be used all year.

There were 165,375 students in the 1990-91 first grade class in Florida. If the sandwich for each student was packaged in a plastic sandwich box for the school year instead of baggies the energy equivalent to over 125,000 gallons of gasoline would be saved annually. The energy in 125 thousand gallons of gasoline could run a stereo for more than 19 million hours. Nineteen million hours is 2,231 years of continuous stereo sound.

Paper Consumption at the Copier

In an office of 50 people, it is easy to imagine the office copier making 500 copies per day. If all 500 copies per day are one-sided, energy equal to 430 gallons of gasoline is consumed at the paper mill to make the 1,250 pounds of paper per office per year.

Many copy machines are able to make double-sided copies automatically. If half of the copies made in only one office were double-sided, the office would save $150 a year, because it would save 65 reams of paper annually. At the same time, 300 pounds of waste paper

and the energy equal to 100 gallons of gasoline would be removed from the waste stream annually. The energy in 100 gallons of gasoline could power a computer for 434 work days.

Individually Wrapped Cheese Slices

The marketing wizardry of the cheese industry has created a wide range of consumer choices at the supermarket. Three of these options are:

1. individually wrapped cheese slices packaged together with an outer layer of plastic,

2. sliced cheese packaged in an outer layer of plastic, and

3. unsliced cheese packaged in an outer layer of plastic.

Plastic wrap around each individual slice of cheese requires that extra materials and energy be consumed by the cheese packaging process to make, wrap and transport the cheese.

The 5,145,115 households in Florida consumed approximately 67,800 tons of American cheese in 1989. If purchased as individually wrapped cheese slices, the energy equivalent to 6.3 million gallons of gasoline was used to make the plastic wrap for each cheese slice. 6.3 million gallons of gasoline is enough energy to run the television and VCR for 270 million hours or 108 million movies.

The 12-oz Aluminum Can vs. the 2-Liter Plastic Bottle

Soda can be purchased in either aluminum cans or plastic bottles made from PET and HDPE plastics. An aluminum can holds 12 fluid ounces; a 2-liter bottle holds 67.6 fluid ounces. An aluminum soda can can be recycled into another soda can; plastic from a soda bottle is "downgraded" to make a non-food container or product to insure sterile food packaging.

The energy required to manufacture an aluminum can with 50 percent recycled fibers is 80 Btu per fluid ounce. The energy required to manufacture all the parts of a 2-liter plastic bottle with no recycled fibers is 114 Btu per fluid ounce. Therefore, 30 percent of the energy needed to make the soda container is saved when 12 oz aluminum cans made of recycled materials are purchased instead of 2-liter plastic bottles.

Aluminum is a popular metal to recycle because it costs less to make a soda can out of recycled materials than out of new metal. In 1989, America recycled 60 percent of the 80 billion cans used.

One out of every four PET bottles are currently being recycled. PET bottles are actually a form of polyester so they can be recycled into carpeting, suits and fiberfill for ski jackets. HDPE can become flower pots and trash cans.

CONCLUSION

If the problem isn't fabricated, a solution doesn't have to be found. MSW can't be completely eliminated, but the size of the problem can be decreased through source reduction. Source reduction includes energy conserving strategies because it takes energy to make things, it takes energy to dispose of things, and the expenditure of energy itself makes MSW. Some examples of how source reduction saves energy have been illustrated in this fact sheet, but there are more energy-saving source reduction strategies just waiting to be discovered.

REFERENCES

Selke, S.E. 1990. *Packaging and the Environment*. University of Michigan.

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Table 1.. The Limitations of Landfills, Incineration and Recycling[1]

Landfills

Generation of Pollutants

- Liquid pollutants from old landfills are seeping into the groundwater. Leachate from municipal landfills has been shown to be a significant source of groundwater pollution.
- Methane, a greenhouse gas with 25 times the greenhouse effect of carbon dioxide, is being generated inside landfills and escaping into the atmosphere.

Capacity Limitations

- The number of landfills in Florida is being reduced and new sites on which to build other landfills are becoming more difficult to find in Florida, where over 1,000 people move everyday.

Waste-to-Energy Incineration

Generation of Pollutants

- Waste-to-energy (WTE) incineration plants burn MSW as fuel. On the average MSW has 4,500-6,000 BTU of heat energy per pound of unprocessed garbage. This energy is used to generate steam or electricity. National studies are currently being conducted to determine the polluting potential of these facilities.

Capacity Limitations

- In 1988, the nine active waste-to-energy incineration plants in Florida burned approximately 3,300,000 tons of MSW, 21 percent of the total MSW generated in Florida. They produced a little over 4 percent of the state's electrical energy consumption for the same year. The leftover ash[2] amounted to approximately 742,500 tons of landfill, a 78 percent weight reduction from the original MSW input.
- Not all MSW generated can be burned in a waste-to-energy incineration plant. Metal and glass products do not burn and several other materials give off toxic substances. Source separation, a labor intensive process, is required to minimize the pollution potential of WTE incineration plants.

Recycling

Generation of Pollutants

- Recycling consists of three different activities: collecting secondary materials, preparing those materials for market, and recycling the materials by manufacturing new products. All three of these activities require energy inputs and produce pollution. It is true that, in most cases, the manufacturing of the new products from recycled materials requires less energy than the manufacturing of the same product from virgin raw materials, but it is not true that recycling does not consume energy. In some cases, i.e., liner board, box board, the energy required to manufacture the product when recycled materials are used is greater than when using raw materials. Also, sometimes products made using recycled paper fibers are more fossil-fuel intensive because the non-paper fiber parts of trees are not available to burn as fuel.

Capacity Limitations

- The materials which are currently being recycled nationwide include paper products, organic matter as compost, certain types of plastics, glass, steel-tin cans, aluminum and used car oil and tires. In 1990, 15 percent of the MSW generated in Florida was recycled. There are several IFAS publications which discuss recycling options.
- Unfortunately, not everything which is thrown away can be recycled. It is too expensive to separate multi-material products, i.e., disposable razors, calculators, lighters, into their base components which is a necessary step before recycling can occur. There is also a limit to how many times paper and plastic fibers can be reformulated into other useful products. For other items there is simply no market for recycled materials.

[1] Office of Technology Assessment, Facing America's Trash: What Next for Municipal Solid Waste. 1989.
[2] Ash is the noncombustible part of MSW.

Table 2.. Waste Minimization Strategies

Method	Example
• Reuse product for original purpose.	• Store brown sugar in an empty glass jar to keep the sugar fresh. • Fill an empty pump spray bottle with water to use as a plant mister.
• Purchase products which have been redesigned to consume less input materials during manufacture.	• The average American car in 1990 weighed almost 30 percent less than its 1972 counterpart.
• Increase a product's useful life by taking good care of it and repairing broken parts.	• It costs much less money and agony to get new heels and a shoe shine on a well built pair of shoes which are already broken in and comfortable than to purchase a new pair of shoes.
• Reduce the consumption of products which have a negative environmental impact.	• Calculator batteries contain mercury and cadmium. Both are toxic substances. Use calculators with solar photovoltaic cells. They make electricity from any light source.
• Substitute reusable products for single-use disposable products.	• Multi-use micromesh coffee filters eliminate the daily disposal of paper coffee filters.

Table 3. Annual Orange Juice Consumption in a 4-Member Household[1]

Wax-Coated Paper Container Size Purchased	Number of Containers Purchased Annually[2]	Annual Cost of Purchased Orange Juice ($)	Energy Used to Make Annual Supply of Containers (Btu)
Small (16-oz)	360	428.40	930,107
Medium (32-oz)	180	340.20	775,089
Bulk (64-oz)	90	269.10	581,317

[1] Based on consumption of 4-oz per person per day or 11.3 gallons per person per year.

[2] Number of containers of given size required to hold annual consumption of 45 gallons.

Table 4. Cost and Energy Advantages of Buying in Bulk

	Number of Containers and Size Purchased		Annual Cost ($)	Number of Nights a Night-Light Could Operate on Energy Used to Make Containers
	360	16-oz	428.40	1,320
(minus)	90	64-oz	269.10	830
Annual Savings			159.30	490 nights

Table 5. Sack Lunch Sandwich Containers

Package Type	Material	Energy Inputs per Container per Sandwich Using 100% Virgin Materials (Btu)	Energy Inputs per Container per Sandwich Using 100% Recycled Fibers (Btu)	Cost per Student per Year ($)
Aluminum Foil	Aluminum	485 per sq. ft.	49 per sq. ft.	5.11
Ziptop Baggie	HDPE[1]	555 per bag	(Footnote 2)	16.56
Plastic Box	Polypropylene	8,081 per box	(Footnote 2)	1.49

[1] HDPE: High Density Polyethylene

[2] Recycled plastic is usually turned into things that do not have to be sterile.