

## The Case for Zero Waste

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*"Although unheard of a decade ago, there is considerable recent interest in designing industrial production processes that produce zero waste...the goal is a worthy motivator."* Kenneth Geiser, Materials Matter

Waste causes great loss of value and resources. Humans are the only species that create waste. We can learn to identify all types of waste and through their elimination, save money and achieve a more sustainable world.

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### Virtual Tour

## Zero Waste - What is it all about?

The visionary goal of Zero Waste expresses the need for a closed-loop industrial/societal system as suggested in Figure 1. Waste is a sign of inefficiency. Our use of the term Zero Waste includes "Zero Solid Waste", "Zero Hazardous Waste", "Zero Toxics" and "Zero Emissions".

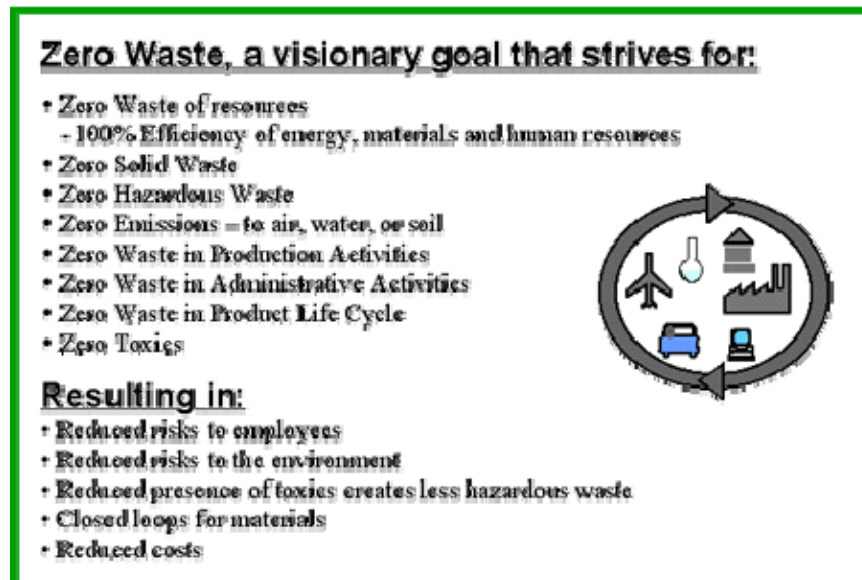


Figure 1. Goals of Zero Waste

Zero waste suggests that the entire concept of waste should be eliminated. Instead, waste should be thought of as a "residual product" or simply a "potential resource" to counter our basic

acceptance of waste as a normal course of events. Opportunities such as reduced costs, increased profits, and reduced environmental impacts are found when returning these “residual products” or “resources” as food to either natural and industrial systems. This may involve redesigning both products and processes in order to eliminate hazardous properties that make them unusable and unmanageable in quantities that overburden both industry and the environment.

Zero Waste strategies consider the entire **life-cycle** of our products, processes and systems in the context of a comprehensive **systems understanding** of our interactions with nature and search for inefficiencies at all stages. With this understanding, wastes can be prevented through designs based on full life-cycle thinking. Indeed, we should work to "design" our wastes, if any, so that they have future applications.

The comprehensive nature of a Zero Waste Strategy is shown in the following input-output diagram:

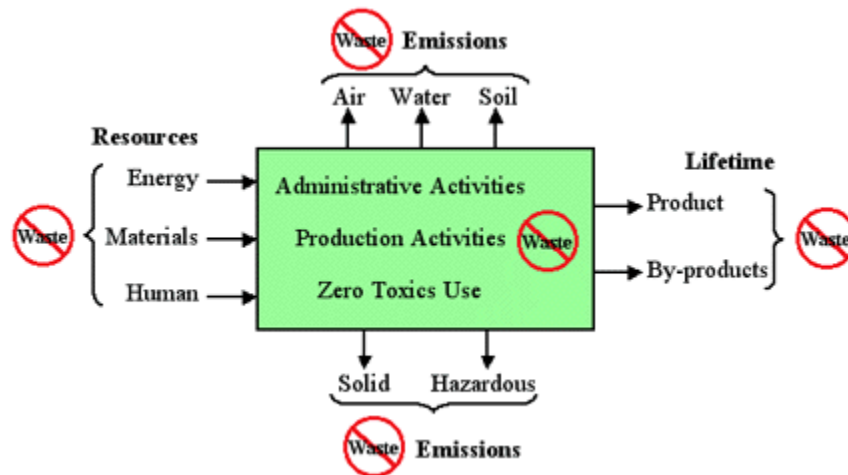


Figure 2. Application of Zero Waste Strategy

A Zero Waste strategy leads us to look for inefficiencies in the use of materials, energy and human resources. To achieve a sustainable future, extreme efficiency in the use of all resources will be required in order to meet the needs of all of the earth’s inhabitants. A Zero Waste strategy directly supports this requirement.

**Broadly applicable.**

The benefits of a Zero Waste strategy can be achieved in nearly any kind of organization. Some examples are:


- **Community programs** can be designed to consider all uses of materials and energy both in operations and services. Focus on zero solid waste to landfills and zero wasted energy can result in new jobs not only in the recovery process, but also in the use of recovered waste products as raw materials to produce new products.
- **Business programs** can be designed to uses of energy and materials in products, processes and services. Focus on increasing efficiency by eliminating solid and hazardous waste, process wastes, wastes in production operations (motion, time, over production, misprinted invoices, etc.) and striving for energy reduction.

- **Industry-wide programs** can be very effective if the industry members are willing to work together. As such, it reaches its maximum effectiveness in reducing energy and material use and achieving environmental improvements.
- **School programs** when applied to all school activities and classroom teaching can save money while providing important education to help the younger generation be prepared to contend with coming changes. Zero waste can be applied not only to energy and material use, but also in the facilities plant, offices, classrooms and cafeteria.
- **Home programs** can be developed that include energy savings, changes in purchasing habits, reduction in the toxicity of cleaning agents, use of more appropriate fertilizers and pesticides. This can help provide badly needed education for the general population.

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## What is Waste?

It is widely accepted that humankind's current interaction with the environment cannot be sustained. Natural systems are cyclical and produce no waste. In our industrial society waste results from the inefficient use of any resource and includes activities and products that generate by-products with no clear use, no market value, or hazardous properties and by-products that decrease their potential value. Waste takes many different forms: from solid and hazardous waste to wastes in energy and material use; wastes in manufacturing and administrative activities and wastes of human resources.

<u>General Wastes:</u>		<u>Seven Manufacturing Wastes (Toyota)</u>
Solid Waste - Garbage		1. Waste from Overproduction
Hazardous Waste		2. Waste of Waiting Time
Waste of Energy		3. Waste of Transportation
Waste of Water		4. Waste in Processing
Emissions to air		5. Waste of Inventory
Emissions to water		6. Waste of Motion
Emissions to soil		7. Waste from Product Defects
Waste of Human Resources		

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## What can we learn from Nature?

We recognize that natural cycles function without producing waste. This can be seen in Figure 1, which shows the cyclical flows of the environment. From a systems viewpoint, the sun provides the energy for the system. The sun's energy drives the photosynthesis processes that order atoms and molecules to higher value such as forest and food products. Dead matter is processed by microbes in the soil to become food for the next cycle. A popular expression of this

concept is that “Waste = Food” (William McDonough).



Figure 1. Nature's cycles.

### What about our industrial and social systems?

Our industrial system today is primarily linear, with “Take-Make-Waste” processes. Materials are extracted from the earth's crust, transported to manufacturing sites, used to produce products (all materials not part of end product are discarded as waste), then products are transported to users and finally, at the end-of-life, discarded as waste. Not only is this inefficient and costly, but these products often contain persistent or toxic materials that negatively impact the environment when they are incinerated or disposed of in landfills.

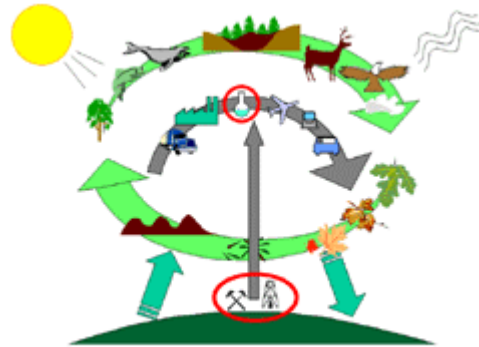


Figure 2. Today's Cycles of Nature and Society

Ultimately, our industrial and social systems will find the cyclical pattern modeled by nature as the most efficient, less costly, and most profitable, which avoids systematic deterioration of the environment. We must find ways to fulfill the equation “**waste = resource**” within our industrial and societal systems. This calls for a cyclical system that eliminates wastes to the environment as indicated by the gray inner circle in Figure 3. The red circles indicate elimination of problematic persistent and/or toxic materials from the earth's crust or from our laboratories. The green arrow from the industrial system to the environment represents outputs that are non-persistent and non-toxic and can be processed by natural pathways. The red arrow indicates materials that cannot be processed naturally. These materials must cycle within the industrial/social system. This is often termed industrial ecology. A popular expression for this

closed-loop industrial system concept is "Cradle to Cradle".



Figure 3. Ideal Cycles of Nature and Society

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## Zero Waste Benefits

### Saving money.

Since waste is a sign of inefficiency, the reduction of waste usually reduces costs. For example, Hewlett Packard in Roseville, CA reduced its waste by 95% and saved \$870,564 in 1998. Epson in Portland, OR has reduced its waste to zero and has saved \$300,000. Interface, Inc. in Atlanta, GA has eliminated over \$90M in waste. Xerox Corp., Rochester, NY has had a Waste-Free Factory environmental performance goal since the early 1990s. The criteria include reductions in solid and hazardous waste, emissions, energy consumption, and increased recycling. Savings were \$45M in 1998.

### Faster Progress.

A Zero Waste strategy improves upon "cleaner production" and "pollution prevention" strategies by providing a visionary endpoint that leads us to take larger, more innovative steps.

*Because of its visionary endpoint, Zero Waste strategies lead to breakthrough improvements as opposed to small step-by-step actions. This not only results in significant cost savings, greater competitiveness and reduced environmental impacts, but also will move us more quickly toward sustainability.*

### Supports sustainability.

A Zero Waste strategy supports all three of the generally accepted goals of sustainability - economic well being, environmental protection, and social well being:

**Economic well-being** is improved by enabling organizations to identify inefficiencies in processes, products and services and thereby to find cost-saving solutions to them.

- Waste Reduction=Improved efficiency and lowers costs
- Costs of compliance with regulations is reduced

**Environmental protection** is enhanced by reducing (ideally to zero) hazardous and solid wastes to nature and by reducing the need for energy generation and hydrocarbon extraction.

- Reduces demand for resources and energy from nature
- Reduces wastes to nature

**Social well being** is enhanced through efficiency improvements that allow more resources to be available for all. In addition, more complete use of "wastes" will create jobs in return logistics and reprocessing activities.

- Waste managers become resource managers
- Opportunities in return logistics
- New products from recovered materials

**Improved material flows.**

Today's system uses large amounts of new raw materials as shown in the following diagram. In addition, large amounts of materials are sent to landfills or incinerated.

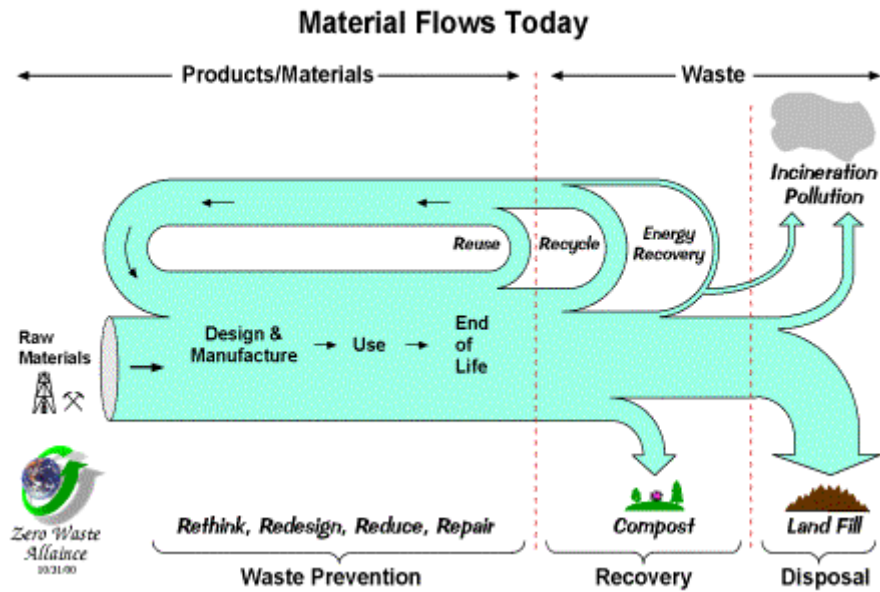


Figure 4. Material flows in today's society

A Zero Waste society would use far fewer new raw materials and send no waste materials to landfills. As shown in Figure 5, below, all materials would either return as reusable or recycled materials or would be suitable for use as compost.

## Improved Material Flows

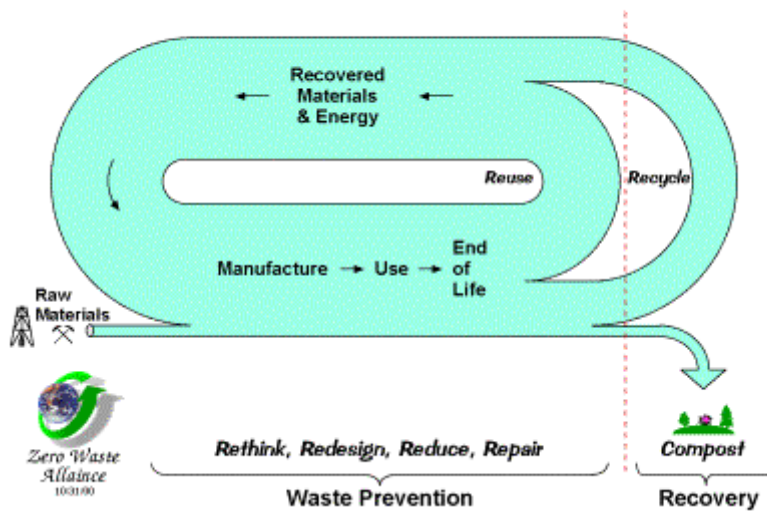


Figure 5. Ideal material flows

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## Summary

Currently we have a growing population faced with limits of resources from the environment. We understand that our society and industrial systems must begin to mimic nature and move from being primarily linear to being cyclical. Each material must be used as efficiently as possible and must be chosen so that it may either return safely to a cycle within the environment or remain viable in the industrial cycle.

The vision of Zero Waste can be seen as a solution to these needs and a key to our grandchildren's future. Zero solid waste, zero hazardous waste, zero toxic emissions, zero material waste, zero energy waste and zero waste of human resources will protect the environment and lead to a much more productive, efficient, and sustainable future. The use of an endpoint goal of "zero" recognizes that simple making small steps without a goal may not achieve a sustainable future while use of a clear defined goal will lead to more rapid innovative improvements.

Zero Waste promotes not only reuse and recycling, but also, and more importantly, promotes prevention - designs that consider the entire product life cycle. These new designs will strive for reduced materials use, use of recycled materials, use of more benign materials, longer product lives, repairability, and ease of disassembly at end of life.

A Zero Waste strategy is a sound business tool that, when integrated into business processes, provides an easy to understand stretch goal that can lead to innovative ways to identify, prevent and reduce wastes of all kinds. It strongly supports sustainability by protecting the environment, reducing costs and producing additional jobs in the management and handling of wastes back into the industrial cycle. A Zero Waste strategy may be applied to businesses, communities, industrial sectors, schools and homes.

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## **Virtual Tour**

[See the Case for Zero Waste as a Presentation!](#)

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