

# How to design for Zero Waste solutions to problems.

## Basic Principles

Any design for ZW necessarily falls back on basic principles. I think this sums them up, but you may want to add more or comment on these. In thinking about the impact of these principles, you can see that moving to a Zero Waste society requires strong social engineering. It is not a trivial, completely transparent add-on that affects nothing significant, such as “a little more recycling” or “shop for green”.

Along these lines, see this NY Times article about green shopping:

[http://www.nytimes.com/2007/07/01/fashion/01green.html?pagewanted=1&\\_r=2](http://www.nytimes.com/2007/07/01/fashion/01green.html?pagewanted=1&_r=2)

### First Principle

1. This is the one principle which cuts across all the others. Design for an entire lifecycle or ecology or an entire industry or an entire commerce or society. Do not design piecemeal, just to improve one product, replace one material, reuse some scrap, reduce some energy use, or solve one limited local problem but look at the entire picture, including all the implications of your changes far from where they are being implemented. Ask where all input products are being manufactured, how wasteful they are, how those manufacturing processes can be changed in turn and what effect your change has on the reutilization of your products.

#### **A. An example: the banning of plastic bags.**

Do not think in terms of bans but do think in terms of an alternative way to accomplish the same thing (except better). The focus must be on the *ALTERNATIVE*, not on the ban. Banning things is a lazy way to greenwash your efforts, compared to the difficulty of designing an alternative.

#### **B. Do not accept a biodegradable alternative.**

Biodegradable plastic is no better than conventional plastic. It does not embody any inherent design for reuse – in fact – it implies the difficult, expensive and labor intensive creation of a highly functional molecule followed by its quick destruction.

#### **2. Push the design upstream to design for reuse, not for discard.**

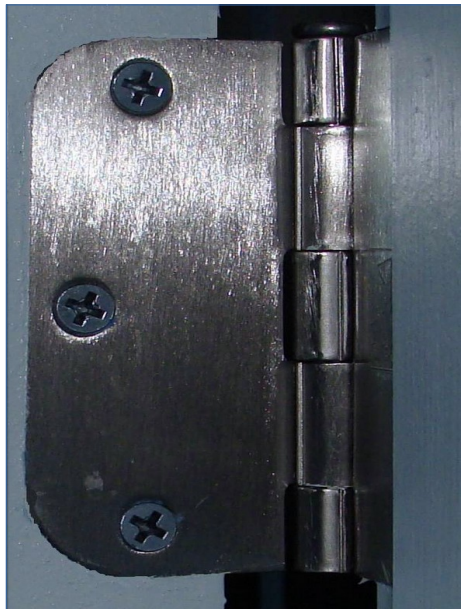
Correct design starts when a product is first contemplated. Just as costs, markets and materials are elementary design considerations, so must perpetual reutilization be. Ending up with degraded or mixed garbage after use is never a given, only a design failure. Planning for post use diversion from garbage is never acceptable.

#### **A. Greenwashing.**

Many companies claim to be green today because of how they handle some scrap or excess, while they blithely send products out into the market that cause untold amounts of discard and waste. Zero Waste is not just a narrow look at your local behavior but an analysis of the impact your designs have on others as well.

#### **B. Control your supplier of parts or materials.**

When doors' recessed hinge cutouts were done with chisels, hinges needed to be square because chisels cut square recesses. When hinge recesses started to be cut out more easily by routers, square corners were a problem so hinges were redesigned to have round corners, thus saving the need to fit a square hinge into a round hole. Before the transition was complete, hinge recesses that were cut with routers had to be wastefully finished with a chisel.



Even when high functional reuse is no longer possible, and an article must be reduced to its component materials for their reuse, employ higher level design to make that operation more effective. Prime examples are metals and plastics because either of them may consist of thousands of possible alloys. Keeping track of their exact composition with markings, bar codes or rfid's is essential to their reuse.

**“Generally, people change their habits when one thing happens — their pants are on fire.” –Lisa Gansky**

### **3. Design to capture the highest function, not the lowest.**

Do not design for materials capture but for the repair and reuse of every article's highest value.

#### **A. Large parts.**

For example removing a large formed plastic part from an automobile and grinding it up into chips is not a Zero Waste operation unless there is no known way to reuse the entire formed part. It is recycling of the lowest value, because all of the resources that were expended to form the part are arbitrarily discarded.

### **4. Materials that are formed by careful and expensive molecular design (such as plastics or alloys) are high function items.**

Any method which destroys molecular organization is a destruction method, even if it masquerades as material recycling. Compostability is never a reuse method for highly organized molecules. Biodegradable plastics are primarily a clever substitution of destruction (greenwashing) under the guise of reuse through composting.

### **5. Composting is a method for recapturing natural nutrient values from very complex natural products.**

It has no role in treating anything else such as “getting rid of garbage”.

Composting is not a special add-on concept but is the normal Zero Waste response to the need for designing closed agricultural cycles.

Read more at: [http://zerowasteinstitute.org/?page\\_id=173](http://zerowasteinstitute.org/?page_id=173)

A. The proper destination for composted materials is the field from which the materials came from originally. That is the way to close the loop. Spreading it on just any field is sub-optimal, even though it is better than nothing.

**6. Someone in charge who simply doesn't want to reuse a part or item "because it is inconvenient or too much work" does not justify using a lower function method.**

Arbitrary personal choices at the expense of the planet are what got us into this mess. Do not honor them.

**7. Do not focus on consumer articles only but include industrial and large scale consumer items in their highest manifestations.**

Do not demolish buildings, cooling systems, processing plants, conveyor systems, display systems, forklifts, trucks, buses etc. but preserve them as complete systems and reinstall them elsewhere as needed. It has been estimated that industrial discards are 70 times more numerous than residential. That is why the efforts by cities to achieve what they trumpet as "zero waste" through "total recycling" is completely inadequate since they begin by working with only 5% of the problem at best.

**8. Build in financing of later reuse at the point of sale, not at the end of a first life cycle.**

Repair, reuse etc. is not an add-on service and cannot be charged that way. It is a commitment that a civilized society makes towards its design for living, and must be allowed for financially and fully at the earliest possible time.

## 9. Separate all articles by logical category, avoiding all mixing.

The garbage mentality claims that all discards are equal, all candidates for dumping, therefore mixing them causes no harm. The Zero Waste mentality claims that all articles are different, requiring different attention to reuse them. Ignoring their separate qualities degrades them. This applies strongly to chemicals, but also to scraps, consumer excesses and all industrial excesses. Especially egregious is the permanent joining of incompatible materials which cannot be reused as a unit.

Some examples:

- A. **The use of glues** to cement plastic to metal or to wood as a cosmetic or protective cover or veneer.
- B. **The use of mortar** (cement) to build brick structures (is there a better way to join bricks together?).
- C. **The use of metallic plating** on other metals (e.g. gold on copper for circuitboards). As always, these may be critical structures for which no obvious alternative is easily found.
- D. **The lamination of different plastics** together, such as for covering food.



## 10. No article for reuse may pass through any intermediate stage in which no one takes responsibility.

This stage will cause irremediable degradation. As soon as an article has no owner, no one responsible, the garbage mentality takes over. This means that articles cannot be 'thrown' into a dumpster for 'someone else' to take care of.

**Who is in charge here? No one!**

A. Emphasize that every owner of an article retains responsibility for the next reuse of that article until the next owner has assumed responsibility. This includes the obligation to preserve information. Allow no zone of irresponsibility, (garbage cans and transfer stations are the current, worst examples), unless someone is in charge committed to reuse and conservation of the history.

Information about all articles is the rock solid basis of reuse.

## **11. The casual, frantic identification of discarded, abandoned articles (as happens in thrift shops) is hardly more than garbage management.**

**A. Information about every article** must be captured and preserved at all times through labels, notations, rfid's, bar codes, Internet sites, specification sheets and every other possible means.

A man rushed into a busy doctor's office and shouted "Doctor! I think I'm shrinking!" The doctor calmly responded, "Now settle down, you'll just have to be a little patient."

## **12. Admit ignorance.**

Design for ZW is a complex operation requiring time, money and research. We do not, and cannot be expected to, have, all the answers. Many of the needed answers can only be found thru research.

**A. Never allow the garbage world** to belittle Zero Waste design because answers must be discovered. It is only garbage dumps which have a single answer for everything.

**B. Universal reuse will demand experts** and expertise, particularly with the more

technical kinds of items but even with ordinary items. It is, unfortunately, no more of a catchall industry for people of mental handicaps than any other technical industry. It is only the handling of garbage, and their low grade form of recycling called diversion, which require no knowledge or intelligence. Reuse is a technically demanding and advanced industry. The answers aren't simple. Often decisions have to be made about intertwined life cycles or the right time to abandon a function or to reconstitute it thru repair or upgrade. You will not be able to answer every challenge: "So what do I do with xxxxx?" Get comfortable with the difficulties.

**13. Challenge everyone to find their own, tentative but innovative solutions to designing in reuse.**

The exercise will convince skeptics that reuse is not all that difficult to design for, once one abandons the notion of the ever welcoming dump.



### **Trash to Shadow**

This is a wonderfully innovative and artistic way to use scraps (note the shadows). It is NOT a Zero Waste project or a way to make garbage acceptable.

#### **14. Do not compete with subsidized garbage management.**

Removal of all subsidies for garbage and a strong upward pressure on all garbage fees is a major weapon for the transition to ZW. The subsidies for garbage are legion and subtle. A big one is that they are allowed to remove a portion of the surface of the earth from future beneficial use, without paying for that loss of planetary surface. Then the industry monitors its dumps for a few years after filling them, after which they expect the public



to pay for all future problems.

## **15. Garbage collection is not a public service.**

The encouragement of garbage creation through collection and dumping does dreadful harm to society. It needs to be eliminated, not honored as a service. Municipalities should not be contracting for it. At least for now, the garbage industry should be forced to compete in the public marketplace, without subsidies, like every other industry, for as long as it still exists.

### **1. The money that is wasted on garbage collection and dumping is money that is spent to destroy our planet.**

We should be removing that money from garbage collection and applying it to Zero Waste solutions and research. There is a huge amount of money available for research into Zero Waste, but it is being squandered today on garbage collection.

## **16. The study of garbage generation, dumping practices, collection fees and other trivia of the garbage industry is not the proper business of the reuse industry.**

It is never a concern of the Zero Waste activist, except insofar as it helps in the elimination of such practices. You will repeatedly be expected by government and the public to involve yourself in solving ‘waste issues’, as though finding a place to dump garbage is an environmental problem. This is usually simple ignorance, not malice, so gently but firmly educate the public about the difference between garbage and universal reuse.

## **17. Collection is neither recycling nor reuse!**

Simply putting “recyclables” into a separate bag is not recycling. Until a specific item has an effective and operational reuse pathway, it is not reused.

1. Just reducing the amount of something going into a dump is not a Zero Waste success. Extending the life of a dump is not a Zero Waste success. Zero Waste successes are not measured at the dump but at the design, reuse or repair facility. The recycling industry has deceived the government into treating the mere collection of electronic goods as some kind of positive virtue, even when there is no known plan for reusing them.

One “collection event” after another is mounted by the Police Dept., the Boy Scouts or a church for toxic chemicals, electronic goods or guns, yet when you read the fine print, you will find not the slightest mention of what will be done with the collected goods, which is, after all, the whole point. Collection is not reuse!

### **17. The measures used for garbage are not valid for measuring Zero Waste progress.**

1. The primary measure for success in reuse is the value of the assembled goods that are reused, not the “amount” of their contained materials, not their weight and not their volume. Those are measures of garbage, but irrelevant to Zero Waste.

### **18. The four most powerful tools for design for reuse are standardization, modularization, repairability and centralization**

For example, standardization can easily be applied to fasteners, which hold things together and which now come in a bewildering variety that is mostly unnecessary. But it applies to electronic and mechanical components of every kind and may even apply to some chemical formulations, such as by standardizing surfactants or oxidizers across some group of products. Modularization means that different functions are present in different components which then are plugged into each other or work together. To see how modularization was used to create a laptop that can be disassembled quickly and easily, without any tools, Click here ...

[https://www.youtube.com/watch?v=WQX\\_NGb5vXs](https://www.youtube.com/watch?v=WQX_NGb5vXs)

Unfortunately the student who invented this delightful laptop, sees it in the video as a tool for recycling. I assume he had no better model in his mind.

He doesn't realize that recycling is a destruction principle in no way dependent on modularization.

Repair does not happen by itself. It must be designed into the original goods. Some of the points of feasibility include easy disassembly, interchangeability of components, identification of the most common and critical of failure points (such as a handle, a wheel, a resistor) and all necessary blueprints and schematics to make it easy to find the failure, especially in electronic devices. Repair parts must be easily available. Repair is a social design event, designed for when the object is placed into social orbit.

While walking down the street one day, a corrupt Senator was hit by a car and died. His soul arrives in heaven and is met by St. Peter at the entrance. "Welcome to heaven," says St. Peter. "Before you settle in, it seems there is a problem. We seldom see a high official around these parts, you see, so we're not sure what to do with you." "No problem, just let me in," says the Senator. "Well, I'd like to, but I have orders from the higher-ups. What we'll do is have you spend one day in hell and one in heaven. Then you can choose where to spend eternity." "Really? I've made up my mind. I want to be in heaven," says the Senator. "I'm sorry, but we have our rules." And with that, St. Peter escorts him to the elevator and he goes down, down, down to hell. The doors open and he finds himself in the middle of a green golf course. In the distance is a clubhouse and standing in front of it are all his friends and other politicians who had worked with him. Everyone is very happy and in evening dress. They run to greet him, shake his hand, and reminisce about the good times they had while getting rich at the expense of the people. They play a friendly game of golf and then dine on lobster, caviar and the finest champagne. Also present is the devil, who is a very friendly guy who is having a good time dancing and telling jokes.

They are all having such a good time that, before the Senator realizes it, it is time to go. Everyone gives him a hearty farewell and waves while the elevator rises.

The elevator goes up, up, up and the door reopens in heaven, where St. Peter is waiting for him, "Now it's time to visit heaven..."

So, 24 hours passed with the Senator joining a group of contented souls moving from cloud to cloud, playing the harp and singing. They have a good time and, before he realizes it, the 24 hours have gone by and St. Peter returns. "Well, then, you've spent a day in hell and another in heaven. Now choose your eternity." The Senator reflects for a minute, then he answers: "Well, I would never have said it before, I mean heaven has been delightful, but I think I would be better off in hell." So St. Peter escorts him to the elevator and he goes down, down, down to hell... Now the doors of the elevator open and he's in the middle of a barren land covered with waste and garbage. He sees all his friends, dressed in rags, picking up the trash, and putting it in black bags as more trash falls to the ground. The devil comes over to him and puts his arm around his shoulders. "I don't understand," stammers the Senator. "Yesterday I was here and there was a golf course and clubhouse, and we ate lobster and caviar, drank champagne, and danced and had a great time. Now there's just a wasteland full of garbage and my friends look miserable. What happened?" The devil smiles at him and says, "Yesterday we were campaigning, Today, you voted.."

Centralization refers to the need to set up Zero Waste Stations staffed by technical people who understand how to move goods on to their next applications, whether by intelligent repair, disassembly or reduction to lower components or materials. This deals with the obvious fact that we cannot expect every owner, user, buyer or consumer to know all the channels for reuse for all products.

Standardization is encountered to great success in some products. Consider adult beds or mattresses, 98% of which which come in six sizes, single, twin, double, queen, king and California king. No one is beset by the appalling and wearisome lack of variety. We can go out and buy sheets quilts and duvets in these six sizes without having to spend endless hours matching inches and centimeters between our uniquely sized mattress and variable beddings. Doors also have some standardization. Most are 28, 30, 32, 34 or 36 inches wide and 76 to 84 inches high, though with many exceptions. Even this moderate level of standardization makes it much easier to find a matching door for an opening. Dot matrix printer cartridges are NOT standardized at all. Every one is different from every other one. Often, just to stimulate extra wasting (leading to extra sales) all four colors must be replaced simultaneously even if three of them are still like new. This is because the printers are given away cheap while the real money is made on replacing unique cartridges at inflated prices. The manufacturers pretend that even the kinds of ink are all different. Can we, as a society, as stewards of a planet, allow this? Are we surrogates for these wasters who design these units or do we have a higher obligation to the Earth?

If you really want to see the insanity of non-standardization, visit a catalog of fasteners. For no good reason that we should respect, there are thousands of designs and if you see one of the unusual ones, you have your work cut out to match it. Manufacturers invent new specs just to make it difficult to repair their units, especially automobiles.

**19. Choose your projects carefully to be solvable and do not accept challenges from the garbage industry to solve their problems on your time.**

Turn the tables on anyone who asks you to design “magical” solutions i.e. instant answers. Design realistic solutions instead, which may require research, and challenge opponents to redesign their own practices to meet your requirements.

“Do not destroy the world unless you have something better to replace it with.”  
Lawrence Ferlinghetti in Poetry As Insurgent Art

“Do not fight against the darkness. First find a spark of light.” Maharishi Yogi

## 20. Design your own terminology.

Never use terminology or conceptual frames which presuppose the methods of the opposition or competition. Under no circumstances use terms like landfill (there is no empty land waiting to be filled with garbage), waste (no article is inherently unusable), waste management (a backhanded way to say garbage is okay), hauling (carrying an excess somewhere is the least important action) or disposal (this has been bastardized to mean dumping). There is no such thing as a “landfill crisis”, a “crisis of capacity” or “too much garbage”. There is no need to find “somewhere to put it”. There is only too little design for reuse. Here is an example of terminology taken hostage – Greenwaste - [http://zerowasteinstitute.org/?page\\_id=139](http://zerowasteinstitute.org/?page_id=139)

“Never call yourself a consumer. A consumer is not a citizen. A consumer has no obligations to his neighbor. A consumer does not function ecologically. A consumer does not give back. The United States is sleepwalking into the future. No amount of alternative fuel is going to bring back the life we have lived. Future life will be local. You will be closer to your neighbors and to your job. Food will be grown closer to where you live. The era of the 3000 mile caesar salad is over. “

Abstracted from James Howard Kunstler, TED presentation.

## **21. Toxicity is an opportunity, not a difficulty.**

Toxic materials are just as reusable as anything else, but they have the added benefit that they have been carefully monitored and controlled so they are available in pure or well understood forms. Chemicals are highly interconvertible which opens many pathways to reuse. Reuse is a universal requirement, which applies to radioactive nuclei in just the same way as it applies to an apple core. There is no other way to make radioactive excesses safe but to find a continuing new home for them. The billions of dollars that have been spent trying to find a place to store “radioactive waste” forever (Yucca Flats), has been wasted. The money would have been much better spent to find uses for all of the radioactive materials.

## **21. Zero Waste thinking should be applied to processes as well as products.**

You need to keep the entire manufacturing process in mind, not just the profitability or materials conservation of one single sector.

## **22. The greatest waste of resources is not found in simple dumping but in the needless repetition of creating products which were designed for one-trip wasting.**

The efforts of creating factories, designs, departments, refineries and machinery and the need for employing human labor is where the greatest waste is encountered. The humans needed for all of this needless manufacturing and services use up all of the inputs that all people make use of. This is where the major waste of clean water, air and soil arises and it will be just as true if all materials are recycled and nothing goes into a dump.

## **23. The needless reuse of resources to make poorly designed products over and over is the real waste that redesign can eliminate.**

This is where Zero Waste intersects with climate change, not in any tiny recapture of lost energy by burning once-used materials as the garbage industry wants us to believe.

**24. Products designed to be reused hundreds of times can be made robust, with many special features to make them strong and convenient.**

They are inherently superior to today's disposable forms. Efficient design leads to effective design.

EFFICIENCY ==> EFFECTIVENESS  
DESIGN FOR A NEW WORLD

“There are those who look at things the way they are, and ask why . . . . I dream of things that never were, and ask why not?” Robert Kennedy, on dreams.

If you want to see how these principles are applied to a bunch of actual ZW design projects, click here - [http://zerowasteinstitute.org/?page\\_id=30](http://zerowasteinstitute.org/?page_id=30)