# PRO 301 – Desain Berkelanjutan Desain Berkelanjutan

### THE DESIGNER'S FIELD GUIDE TO SUSTAINABILITY

### Make it modular

Modular designs are more easily repaired, and recycled

## Maximize recycled, recyclable, renewable, and biodegradable materials

PET, Polypropylene, HDPE, Wood, Steel, Aluminum and PLA for example

### Minimize fasteners

Fasteners add weight, material variety and assembly/disassembly complexity

### Don't use paint

Painted plastics are less likely to be recycled

## Question the premise of the design

Consider other approaches to the problem at hand

### Make is less complex

Simple, elegant designs are often the least impactful

### Make it more useful

Multiuse products can reduce consumption and increase convenience

## 01 WHAT IS IT TRYING TO ACCOMPLISH?

## HOW IS 03

WHERE DOES

### **Design for Upgradeability**

Make standard internal components accessible and self explanatory

### Create durable and high quality designs

Make products people want to keep...and make them last

### Design for life after death

A secondary use for a product adds value and helps reduce waste

### Reduce material variety

This can increase recyclability and can decrease manufacturing energy

### Avoid toxic or harmful materials and chemicals

PVC, polystyrene, lead and BPA for example

### Reduce size and weight

This reduces emissions during shipping

### Optimize manufacturing processes

Powder coat vs. paint. Pressure form vs. RIM Talk to your manufacturers about low energy, low waste alternatives

### Design packaging in parallel with products

A green product in a wasteful package should be avoided whenever possible

### WHAT IS IT TRYING TO ACCOMPLISH?

### 0.1

### QUESTION THE PREMISE OF THE DESIGN.

Consider other approaches to the problem at hand. Is the form factor that you had in mind really. the kest way of accomplishing the task? Is any form factor the best way of accomplishing the task? Maybe a service fits the mold better? Ferhaps the unswer lies within an existing product?

Example: Instead of designing a special arm. Watch out: Be sure to always consider a diband to carry a runner's keys during a workbetter example? Go to LUNAR's sustainability blog at http://lunorelements.hlogspot.com/ and post it for the world to see,

ent's economic performance goals when apout, design a running sock with a key pocket, plying this method. Even though a behavioral People are going to buy socks anyway. Got a change could solve the problem at hand (like putting a key under the mat, in this example) the client would be left without a product. Suggesting that they move to a sock instead of an armband may still meet their financial objectives.

### 0.2

### MAKE IT LESS COMPLEX.

Simple, elegant designs can reduce material, weight, and manufacturing processes. Simple designs usually also mean less material variety and can help make a product more recyclable.



Example: Benjamin stools from IKEA are a Watch out: Keeping designs simple can somesimple and elegant design. They are made of times lead to overlooking an opportunity to a single material, with a utilitarian but elegant increase the usefulness of a product without form factor. This makes them lightweight increasing its ecological impact (see below). and incredibly portable. They can be used

### MAKE IT MORE USEFUL.

table, etc.

as a sitting stool, a stepping stool, a coffee

At first glance, this may seem to contradict point number 2, but there is a big difference between usefulness and complexity. Taking advantage of a natural or logical extra use for a product will not only make the product more desirable and interesting, it will also help reduce the number of graducts headed for landfills. Multiuse products can reduce consumption and increase convenience.



Example The shape of the flat-head screwdriver on many pocket knives has been cleverly designed to also function as a bottle opener. The usefulness of the device has increased with no added material or complexity.

Watch out: Be careful not to let added usea better functioning model.

### HOW IS IT BROUGHT TO LIFE?

### 04

### REDUCE MATERIAL VARIETY.

Designing as many aspects of the product as you can from the same material makes recycling the product at its end of life easier, more efficient, and more profitable.



Example: At its Chupai, Taiwan plant, Philips Watch out: Be sure to not use harmful ma-Electronics designed the Typhoon, a high-end color monitor, using green product design techniques. As a result, the monitor requires 35 percent less time to manufacture than a conventional monitor due to a 42 percent reduction of material and components.

terials in the name of reducing material variets: Non-recyclable, non-renewable and toolc materials should generally be avoided when possible. Deciding early on to use recycled, recyclable, renewable and biodegradable materials for major components of the design will help reduce material variety without negative side effects.

### AVOID TOXIC OR HARMFUL MATERIALS AND CHEMICALS.

Materials like PVC, neoperne or polystyrene, and toxic chemicals and additives like hisphenol A and formaldehyde should be avoided when possible. Many of these materials have suitable non-toxic counterparts, like copolyesters or bioplastics, and additives can be eliminated by choosing materials wisely.

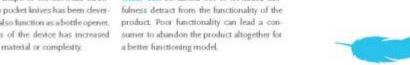


a copolymer with almost identical properties but without the associated health risks.

Example: Nalgene water bottles have recently Watch out: Make sure to consider the enswitched one of their material selection (a ergy input for the entire production cycle of polycarbonate that contained bisphenol A) to the alternative material chosen and the likely disposal method for the product. If proper disposal or recyding can be guaranteed, less friendly materials may be a safe, best performing, lowest energy material choice for the job.

### REDUCE SIZE AND WEIGHT.

Lightweight products can reduce earlien emissions and cost by making the shipping process more efficient. Weight can often be sated by focusing on choosing lightweight materials, simplifying designs, and eliminating unnecessary fasteners and components.

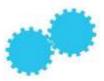


ate a design that delivers all the processing. harm than shipping a heavier one once. power and features of a regular PC with less impact on the planet.

Example: The HP Pavilion Slimline PC is 1/3. Watch out: Don't sacrifice durability in the the size and half the weight of a traditional name of weight savings. Less durable prodtower PC. Using weight/space-saving design - ucts need to be replaced more often and shipapproaches. HP and LUNAR were able to cre-ping a lightweight item twice can cause more

### OPTIMIZE MANUFACTURING PROCESSES.

Determine which manufacturing processes make the most sense for your product. For lower volumes or less complex parts, consider vacuum forming instead of injection molding. For some complex metal geometries consider easting instead of much ining.



consider powder coating instead of painting. The powder coating process allows for excess. powder to be collected and reused in the coating process, as opposed to paint overspray, which cannot be recovered.

Example: When a metal must be coated, Watch out: Manufacturing processes are complex systems and often energy or materials waste can be hidden within these systems. Talk with your manufacturer to make sure you understand the entire process and consult indexes like the OKALA or impact factors table. to make sure that all aspects of the process are considered.

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### DESIGN PACKAGING IN PARALLEL WITH PRODUCTS.

If a product is designed with a stylish and sustainable packaging scheme in mind, a client might absorb that idea. Lightweight packaging that was nustriouble (recycled, recyclable, or biodegradable) materials can reduce surbon emissions and raw materials waste althe.



are more concentrated and require less pack- design as well. aging, such as bottles that are stronger yet lighter in weight, packages that do not require outer cartons, and the use of stronger lighter materials in place of heavier ones," The results of this packaging design blitz are that "overall puckaging per case has been reduced by 23% and waste, air and water emissions have been reduced by \$7%" since 1990.

Example: P&G's focus on packaging in the Watch out: Always keep in mind that unneceslast 15 years has produced staggering results. sary packaging complexity, while sometimes According to bsr.org, "The company has used - creative, is unnecessary, Remember that all computer models to develop products that of the tips in this guide pertain to packaging

### HOW IS IT USED?

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### DESIGN FOR UPGRADEABILITY.

In the electronics industry, the technology in a product can become obsolete long before the design. Designing products that can be upgraded to keep up with moidly changing technical performance can save materials and money.



Example: The HP MediaSmart Server was designed with simple upgradeability at its core. Purchasable with varying starting amounts of storage, its capabilities can be upgraded by simply adding a drive when the time is right: a process that HP and LUNAR made sure was a simple task for all.

Watch out: Products that are designed to be upgradeable without being designed to be durable may break before they are ready for an upgrade. This could result in adding undue complexity to a design that won't be upgraded after all.

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### CREATE DURABLE AND HIGH QUALITY DESIGNS.

People want high quality products that will look and function beautifully long after the competing product has died, and they're willing to pay a little more for that type of design. Designed properly, products can transcend the "throw away" culture that dominates electronics today.



Example: Craftsman hand tools have estabon selling high quality, durable tools, and backing them up with a no questions asked lifetime warranty.

Watch out: Not all products should last foreylished a well-earned reputation for being built er, inherently limited use or single use prodto last. While some brands of less expensive ucts, like medical disposables, food packagtools are cast with shouldy processes causing ing, toothbrushes (the heads, at least) should them to fail, Craftsman has built their brand be designed to be the opposite of durable. Design temporary items to be absorbed back into the technical nutrients chain by making them fully recyclable, or back into the earth by making them biodegradable or compostable.

### DESIGN FOR LIFE AFTER DEATH.

Most products don't last forever. Products designed to have secondary usages after their primary. function has lagsed can add value to the product, and may fill a need that would be filled by unother purchased product instead.



Example: Adding graduated lines to the side of a salad dressing bottle makes it useful as a measuring device after its initial use.

Watch out: Trying to work unnecessary second uses into a design can often increuse the complexity Design a product's second life such that it requires no extra parts or complexity that wouldn't be needed in the original design.

### WHERE DOES IT END UP?

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### MAKE IT MODULAR.

Modular designs are not only more easily recycled at the end of their life but also more easily repaired, and therefore last langer. Modular designs can also be more efficiently manufactured and shipped, reducing energy consumption at the beginning of the product's life.



Instead, If the chair breaks, replacement that can accomplish multiple tasks. parts are ordered and the chairs are easily repaired on site.

Example: An example of this principle is the Watch out: Making designs overly compli-Aeron Chair by Herman Miller. One of the cated in order to make them modular can do design considerations for the Aeron was to more harm than good. Adding extra fastenmake it "...sparing of natural resources, du- ers, brackets, and materials opposes tips 3 rable and repairable, designed for disassem- and 4. Try to design for modularity that can be bly and recycling." As a result, Aeron chairs had for "free" using creative features on inare not sent back to retailers for repair. jection molded parts or pieces of sheet metal.

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### USE RECYCLED, RECYCLABLE, RENEWABLE, AND BIODEGRADABLE MATERIALS.

This one's obvious, but should always be kept in mind. Design with meyeled or easily recyclable. plastics (HDPE, PP, PS, PVC), biologradable plastics (PLA, PHB, polyamide, blo-derived polyethylene), paper, surdhound, trood, stainless steel, aluminum, etc.



milk jugs from local recycling facilities. All of the Green Toys products are both recycled and recyclable.

Example: San Francisco based Green Toys: Watch out: Sourcing sustainable materials makes children's toys entirely out of recycled from distant locations can sometimes prove more harmful than beneficial. Biodegradable. plastics produced in Australia, molded in China, and then shipped to the US can be more detrimental than standard plastics produced and manufactured closer to the product's point of sale.

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### MINIMIZE FASTENERS.

Minimizing fasteners can make large portions of the product more easily recyclable at the end of life since removing snap-on parts can be done completely and quickly without the use of tools. This also eliminates multiple fasteners from the product BOM and reduces the amount of assembly time necessary to get products out the door, which reduces cost on two fronts.



maintenance and more easily separated for eccycled without disassembly. recycling at the end of their lives.

Example: Dell computer bezels are assem- Watch out: Sometimes a single fastener can bled with snaps that are had for "free" by in- avoid large amounts of part complexity and tegrating them into the design of the part that a material variety. Also, if the fastener is made is already being injection molded. This also of the same material as the parts it is joinallows them to be more easily accessed for ling, the entire assembly may be able to be

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### DON'T USE PAINT.

Painting a material generally makes it harder to recycle at the product's end of life because the paint tunnot be easily reparated from the material. As a moult, many painted products are either not recycled or are irresponsibly melted down to burn off the paint, creating took fumes and lower availity recycled material. Design products to take advantage of the natural beauty of materials.



means they can be scratched or worn without reground and reused to make good parts. degrading their appearance. This choice also saves HP the costs associated with adding a painting stage in the manufacturing process.

Example: The HP Photosmart 7850 printer. Watch out: Eliminating paint on appearhas plastic parts made almost entirely out. ance parts could result in lower yields in the of highly recyclable, non-painted plastics. In molding process. Discuss this with the part addition to making the plastic components - manufacturer to determine acceptable yield more easily recyclable, having mold-in color rates. Also verify that unusable parts will be



**Green design** atau **eco design** adalah sebuah gerakan berkelanjutan yang mencitacitakan terciptanya perancangan dari tahap perencanaan, pelaksanaan dan pemakaian material yang ramah lingkungan serta penggunaan energi dan sumber daya yang efektif dan efisien





menurut arsitek, Riri Novriansyah, green building atau green design erat kaitannya dengan energi, terutama yang berdampak bagi lingkungan, sosial, masyarakat, serta ekonomi. sosial, manusia, ekonomi, dapat diambil irisannnya, di sanalah green design berada. "Green design harus bisa menguntungkan, secara sosial menaikkan kualitas hidup manusia dan lingkungan tidak terbebani," ujarnya.







Komponen untuk mewujudkan ide besar green design tersebut dapat melalui pengolahan energi, air, material, dan kesehatan penggunanya.



