

# Energy Effectiveness



## Example 1

by Sarah Dehlinger, Jake Hvistendahl, Joel Kohn, Jessica Papa (2013)

### Comments:

**Energy Priorities:** Fantastic find for your first citation—I'm totally keeping that for future years! I'd probably disagree with your conclusion of eliminating charging efficiency from your priorities, though. You clearly explained why you did it, but I think you're forgetting the middle-ground possibility where you don't need the cart to have cables for that particular version of iPad (or other tablet), the slots could have USB plugs, and then the tablets use whatever custom cable they need to plug into USB. Still, well-researched, rigorous calcs, and clearly argued.

**Brainstorm Reduce Energy Use:** Good things: You had way more than 20 ideas for each brainstorm, and clearly labeled which ones skipped steps, and appeared to have an idea for each part of the system in each brainstorm, and there was a clear difference between the ideas reducing energy use vs. the ideas using cleaner energy.

One thing that could've been better, though: You listed the brainstorm ideas on the system map, but in a vague way—e.g. all the ideas for physical components of the product were in one thought bubble, not clearly showing which ideas went to which components, so I couldn't tell if you had an idea for each component. You were making it all very pretty, but brainstorms don't have to be pretty, they're a messy process. When listing skipped parts of the system, you were often a bit vague about what was being skipped—for instance, several ideas that eliminated the need for dividers said they were skipping "aspects of extraction, manufacturing, and assembly", but it'd simpler and clearer to say you're skipping the dividers.

**Energy Reduction Recommendations:** Your calculations for energy reduction & energy impact reduction (which in your case are the same, all done in SustMinds) look reasonable, and you showed your "math" by including the graphs by SBOM.

This is a nice bonus, but was not necessary for this exercise on energy efficiency.

Your renderings are fantastic—they look great and also show what's happening design-wise (BTW, nice idea on the "skeletonizing" cutting a single sheet into two walls.) It seems like your two final design recommendations are both good ideas, though it did seem like a missed opportunity to not have more power-related options, like the solar panel one (its % reduction was huge, if it was accurate), but you made an argument for it.

Also good showing the % improvement for everything right up front. Just a couple notes there—the "+" signs could be a little confusing, because that can mean an increase in environmental impact. The green text was good, though. You might fix it by saying "reduction from baseline" rather than "change from baseline". Also, it was a little odd to have the baseline(s) in the middle/bottom of the table rather than at the top, since starting with the baseline gives you context for everything else.



## Anthro Furniture / 9.1 Energy Priorities

Overall Rating:

### A9.1 Energy Priorities

Sarah Dehlinger

Jake Hvistendahl

Joel Kohn

Jessica Papa

#### Biggest Energy Impacts

1. Charging Tablets
2. Vampire power (best or worst case scenario)
3. Steel Structure

#### Top Priorities

- |                    |                                |
|--------------------|--------------------------------|
| 1. Vampire Draw    | 4,730.4 MJ / lifetime, average |
| 2. Steel Structure | 1,158.1 MJ embodied energy     |
| 3. ABS             | 520.8 MJ embodied energy       |

#### Discussion

We estimated the energy consumed in charging iPad tablets from 25% to 100% charge, with a supplied power of 12W from the charger (6V, 2A)<sup>1</sup>, charger conversion efficiency of 78%<sup>1</sup>, a battery capacity of 11,560 mAh<sup>2</sup>, and a charger draw of 62mW when not charging the tablet. While the tablet is an integral part of the product system, it is separate from the product itself. Improving the AC/DC transformer to one that is 99% efficient could save 24% of the energy for charging, but not only could the inclusion of a transformer with the product make it tablet specific, but it also may make it tablet version specific and would greatly reduce the useful life of the Anthro product; the Calcs" tab. What we're calling "Vampire Draw" is the energy required to operate the power strip electronics in the cart, mainly the power indicator light. We based our assessment on both a best and worst case scenario with differing durations of 6W consumption.

Sources:

1. <http://www.righto.com/2012/10/a-dozen-usb-chargers-in-lab-apple-is.html>
2. [http://en.wikipedia.org/wiki/IPad\\_%284th\\_generation%29](http://en.wikipedia.org/wiki/IPad_%284th_generation%29)

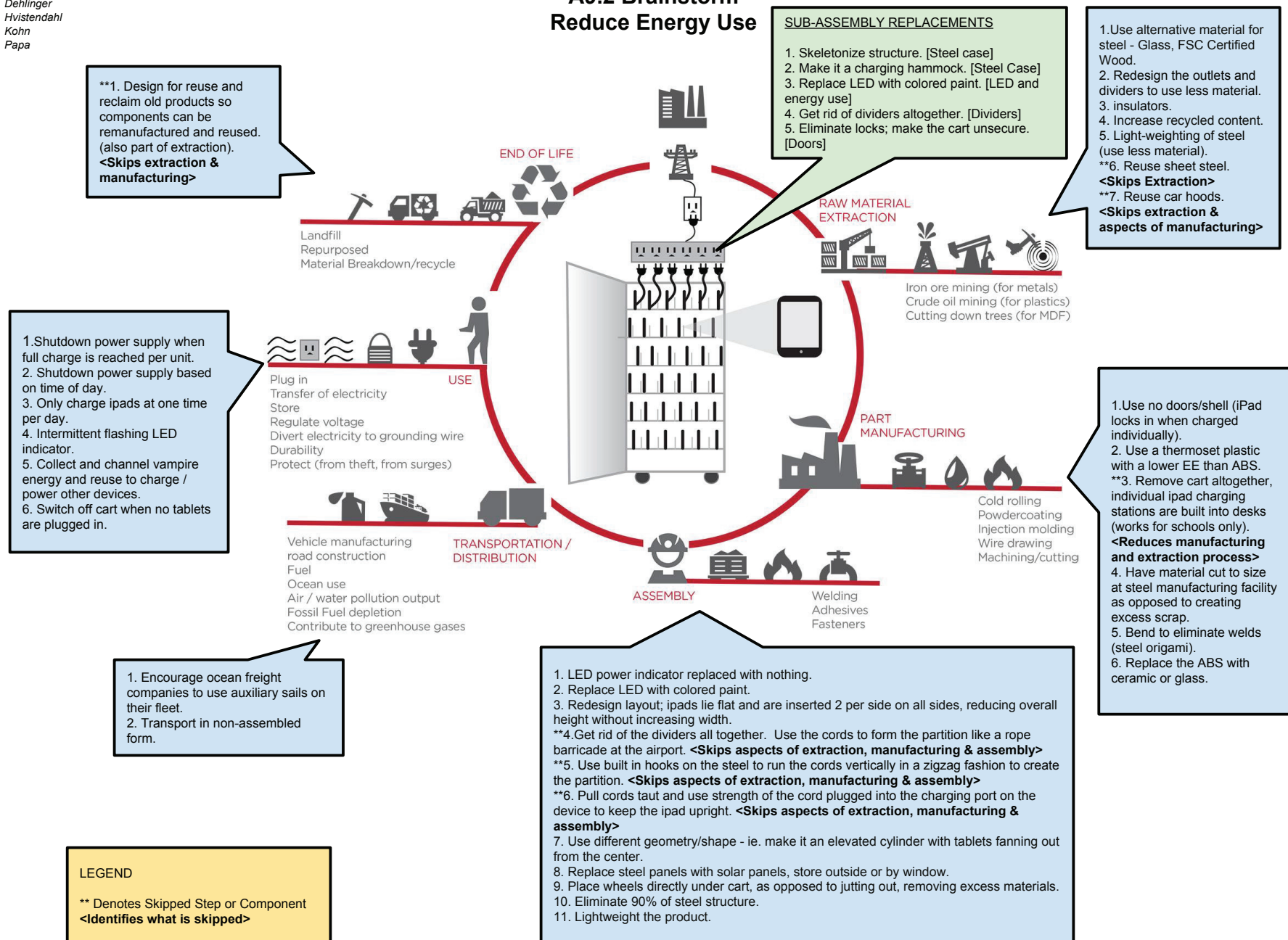


## Energy Effectiveness: Example 1

by Sarah Dehlinger, Jake Hvistendahl, Joel Kohn, Jessica Papa (2013)

2013-10-24  
Dehlinger  
Hvistendahl  
Kohn  
Papa

### A9.2 Brainstorm Reduce Energy Use



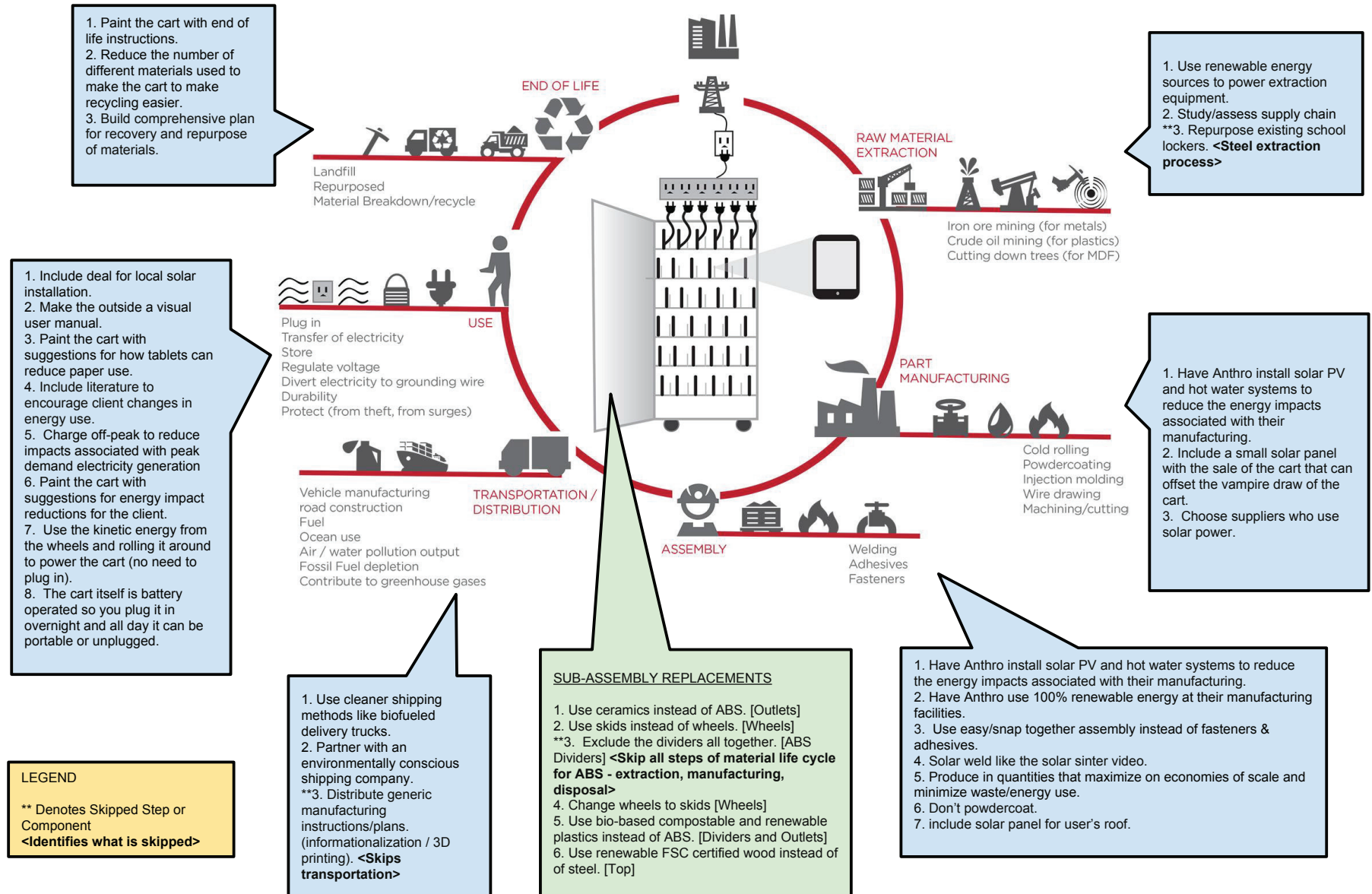


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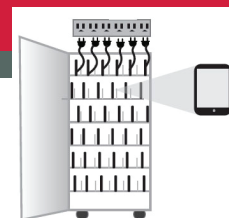
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### A9.2 Brainstorm Reduce Energy Impacts





## ENERGY REDUCTION RECOMMENDATIONS



## LCA Results

## CO2 Analysis

Overview Concept Layout	CO2 eq. kg / functional unit	Reduction in Energy Use	Reduction in Impact	Change from Baseline	Percent Change
Redesigned Layout directly stacking on top of one another	1.5 x			.9 +	38%
Substitute hardwood for Steel*	1.7	x		.7 +	29%
Skeletonize Structure*	1.7 x			.7 +	29%
Lightweighting Steel	2.2 x			.4 +	8%
Eliminate dividers, use existing device cords instead	2.3 x			.1+	4%
Replace wheels with skids	2.3	x		.1+	4%
<b>Baseline</b>	<b>2.4</b>			0	0%
Replacement Powder Coating	2.4	x		0	0%
Solar to eliminate Vampire impact	4.9	x		4.9+	50%
<b>Baseline w/Vampire Draw impact</b>	<b>9.8</b>			0	0%

\*Indicates selected design recommendation

## Summary of Results - Winning Designs

Substitute FSC Certified wood for steel cabinet components

We chose this as one of our design recommendations because it showed the second largest reduction in energy use. The impacts of energy use for the wood are less than that of steel. When the reduction of energy use is the highest priority, the results of our LCA show replacing the structural steel components (frame and doors) with wood, we can achieve a 29% energy impact reduction.

## Skeletonize structure

Per the result of our LCA's, this redesign idea had the biggest reduction of energy impacts. With a 29% reduction, this is our second design recommendation. With this option, we can greatly reduce material use which reduces the overall impact of the cart. The cabinet can also still remain secure and allow for ventilation. We included the additional energy required for cutting, but since the cut allows us to use one sheet for two sides, we still saw a large reduction in the impacts of energy use which led us to select this option as a viable design recommendation.

## Non-Winning Designs

Redesigned layout - directly stack tablets on top of one another

This option assumes a much smaller cabinet based on the average size of a tablet. This option showed the biggest reduction, however, we still had concerns about how tightly they can be stacked together since they generate heat while charging. The idea of a smaller cart could also be used in combination with many of our other tested ideas, so we did not include it as a primary recommendation for now.

## Use solar panels to eliminate vampire energy draw

For this scenario, we added in to our original baseline, an estimated energy use for the when the charging cart is plugged in, but nothing is being charged. We then looked at what energy reduction could be achieved if we incorporated a solar panel to reduce the "vampire energy draw". We assumed the charger uses 6W (similar to a power strip) and would sit empty for up to 16 hours, 365 days a year, with the tablets just being charged over night. We added in the solar component, but it was difficult to make an accurate assumption on the material composition and weight, so we ultimately decided not to pursue this option.

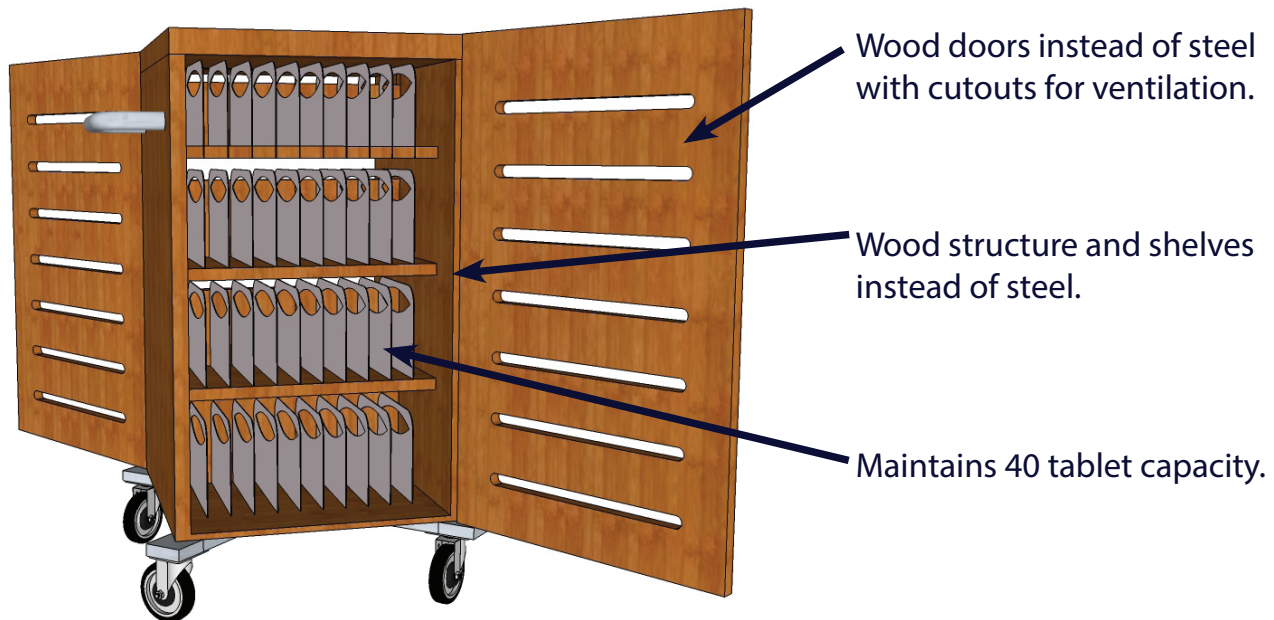






## REDESIGN FOR REDUCED ENERGY USE

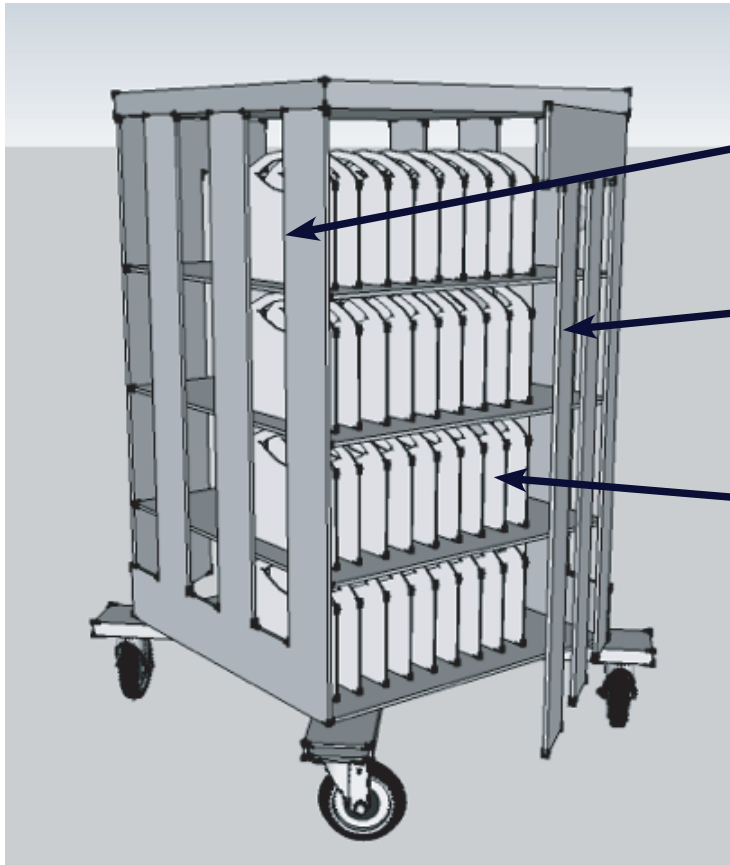
Substitute FSC Certified wood for steel structure





## REDESIGN FOR REDUCED ENERGY IMPACTS

### Skeletonize structure to reduce material use

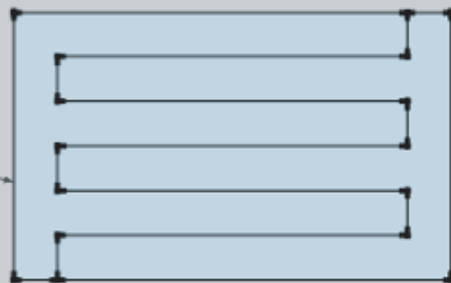


"Skeletonized" structure with metal cutouts to maximize material use.

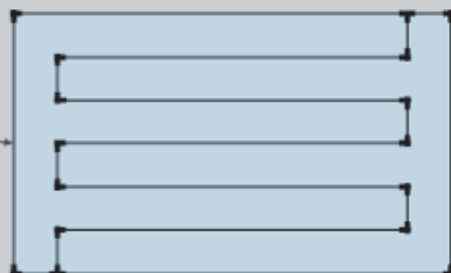
Lighter-weight cart with better mobility due to less materials used.

Maintains 40 tablet capacity.

Get two sides from single sheet



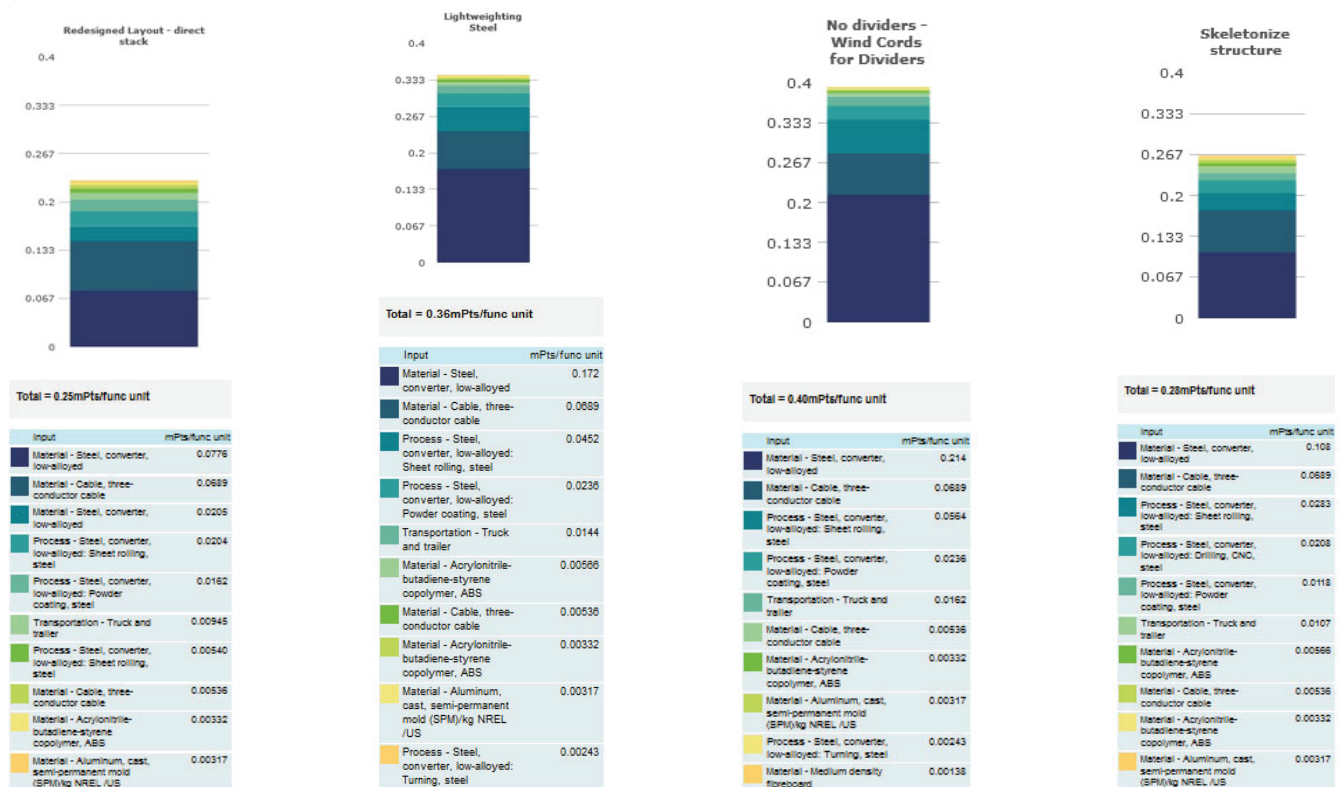
Steel sheet cut into "teeth"





## APPENDIX - LCA GRAPHS FOR REDUCED ENERGY USE

### Total Impacts by SBOM Input



### Carbon Footprint by SBOM Input

