

# Do Better. How to Improve the Sustainability of Your Products Panel Q&A Responses

We couldn't get to all the questions in the panel talk, but we all are passionate about sharing our knowledge in sustainable design, so have pulled together brief written responses to the questions submitted in this document. We hope this inspires you all to continue to engage in this area, and find ways to make a difference.

## Questions

**As a new sustainability professional, what recommendations do you have for continuing education, certifications or groups to join and be more involved?**

There are some good LinkedIn groups that you can join, focused on a range of topics. I would recommend looking into areas of specific interest, either focused on your areas of expertise or in spaces you want to learn more.

As a field everything is progressing quickly, so staying up to date on the latest news is important, GreenBiz is a great resource to learn more about sustainability.

**More and more products are smart and connected which inherently induced data being generated and stored. This in turns will need data storage and other computing and indirect emission. Could you share a word on this problem?**

Compared with the energy and resources that go into a device, the energy to store the data is usually comparatively insignificant, but this varies based on the scale of the smart product. Cloud based data storage is often done in large facilities where the companies are trying to maximize cost savings that track with sustainability gains in energy use.

**Similar to your point about cost, could you share examples where both a positive environmental impact and a hard economic ROI came together from a sustainability effort? Thinking about how we get more companies on board and engaged.**

Winnow is a great example, where AI is used in commercial kitchens to track food waste, ultimately leading to recommendations for optimization. This has significantly reduced food waste, along with associated costs, reducing food costs by 3-8%.

## **What are the top 3 sustainable design elements for consumer electronics that have the most significant environmental/social benefit?**

Often a consumer electronic LCA points to the PCBA as the biggest hot spot, so if possible eliminating the PCB, or finding ways to make it smaller is often the number one thing. Sometimes the electrical components that go on the circuit board have a large negative impact, given the chemicals and conflict minerals involved. Another big impact component is motors, it's important to carefully consider sourcing, and life expectancy can be big there. Depending on the product and its life, energy usage as Daniel highlighted, can be quite large, especially in an "always on" device, or one that has many hours of life. But again, detailed LCAs are the only way to know for sure.

One thing to consider, that was discussed in the panel, is how to extend product or component life, especially for the biggest impact components. This could be through taking back products at the end of their first life, refurbishing and selling again. There are not only environmental benefits here, but potential social benefits, by providing lower cost products to those that may not have access to them otherwise.

## **What plastic options are there with lower impact? What limitations are there on recycled plastics?**

There are many plastic options out there now, from a variety of feedstocks. I recommend looking at the publications from a variety of suppliers, and asking them about their renewable feedstock materials. As an example, some suppliers use waste products from the paper and timber industry.

With respect to recycled plastics, there is now a wide range of recycled plastics to consider. There are mechanically recycled plastics, taking either post-consumer or pre-consumer waste, often blending it with virgin material to achieve consistent properties. Many material suppliers provide materials with recycled content, with their own specific datasheets, specifying material properties. For mechanically recycled materials there will typically be a slight reduction in mechanical properties due to the thermal history of the material and impurities (although this gap has been reduced or even eliminated in some recent developments), as well as limitations on the colorability of the polymer. There is also typically a slight cost premium, due to the processing efforts.

A newer option that allows recycled plastics to match the virgin material properties is chemical recycling, where recycled materials are broken down to their monomers and then

re-polymerized. This is more expensive than virgin materials and is currently limited to higher performance materials (such as making PBT from recycled PET bottles). That being said, this is an area we can see growing as economies of scale are implemented, and it allows for a truly circular use of material. As the infrastructure and technology for recycled materials grows, cost will hopefully become more competitive.

### **What are some quantifiable ways to consider energy consumption and impact throughout the whole product lifecycle?**

LCA tools are a great resource for this, which look at the impact through all life stages of a product (materials & manufacturing, distribution, use, and end of life). By running the assessment you can identify which life cycle stage has the biggest impact - which may or may not be related to the energy consumed during the product use phase.

Your results will only be as good as the data you put in so the first step from an energy standpoint, is to calculate or measure the energy consumption by the product during use. This can be done by understanding the expected power draw, duty cycle, and lifetime of the product. It's fine to make assumptions early on, but as the design matures make sure to re-evaluate the assumptions and calculations using actual customer data and test results.

### **How do consumers and retailers know what is best, and how do we align to this?**

That's a great question and something that many struggle with in their personal lives. There are certifications that can help distinguish sustainable products or key claims that can be shared in product marketing, such as "made from all 50% recycled content", etc. Only through education and transparent data can folks really know what the most sustainable option is. Unfortunately today there is a lot of misinformation out there, and greenwashing is a real risk.

### **I'd love the panel's perspective on communicating LCA information like carbon footprints directly to consumers - do you believe this will be a useful and decision-making metric for the lay consumer as they choose which products to buy? Or will LCA remain as part of internal product design considerations?**

LCA outputs in their raw form are not usually very marketing ready, and are best used for making internal design decisions. If you are applying LCA to an existing product for the first time, you can net some good marketing nuggets like "33% less plastic!" or "conflict-mineral free" or similar. One of my colleagues discussed in an article, how products could be given a carbon cost label to go alongside the product cost, to allow consumers to make decisions on products based on their impact. It's an interesting approach that would require LCA carbon data and could allow consumers to make more informed choices. The communication of scores that matter need to be clear, transparent, and meaningful to the consumer.

### **Tips on engaging stakeholders and making the business case, getting R&D budget and right brief in the first place for sustainable design and new business models (that potentially are about selling and growing less).**

There are many ways to engage stakeholders, I expect many will be influenced by data showing that companies that incorporate sustainability are more successful. Recently Blackrock published a letter to the Fortune 500 CEOs stating 'we believe sustainability should be the new standard for investing', and that 'climate change risk is investment risk'.

In making the business case for sustainability, it is important to introduce the risks of not doing so along with various opportunities for higher return. You should be forward thinking, consider whether upcoming regulation may be introduced into your market or if upcoming carbon pricing will impact your product cost. You may see changing consumer attitudes and a competitive advantage to focusing on sustainability now.

To get the right brief in place for sustainable design I recommend referring to the ebook we've shared today. Focus especially on the 'Innovate' section where we discuss identifying the sustainability goals for your company, distilling them into specific product or project objectives, and then refined them into specific measurable product requirements.

### **How to better estimate and provide financial benefits of designing a sustainable product to business stakeholders?**

There's no magic bullet here, but if you can do the initial step of at least doing an LCA to assess hot spots, and then getting creative around those hot spots, you may be able to propose some sustainability wins that also deliver cost benefits. I.e. if you can combine two parts into one, you may save on material cost as well as having a more sustainable design. If you can redesign so

parts can be separated, you've made it more recyclable and serviceable AND you may have saved on costly assembly methods.

**When making product development decisions, how do you determine ROI on product sustainability so it can be evaluated against performance improvements and capital investments?**

This usually requires quite a bit of data to do an adequate job. Once the LCA is done, the picture of the hot spots is complete, you can take the top tier of hot spots and assess the investments and potential performance impacts required. We hope to find 'local maxima', where the sustainability and benefits are maximized and the cost is acceptable. In cases where the hotspots point towards simplification, the cost and benefit may be correlated. The results of the LCA will often show many things that are not comparatively impacting the sustainability, which indicates they are not worthy of further investigation, since the benefit is likely to be low.

**Are you doing any work in the transportation sector to minimize gas emissions from vehicles on the roads?**

Synapse hasn't currently engaged in any of this work (we do admire the work our friends over at TrailerTail are doing in fuel efficiency retrofits.) But we are engaged in things which can secondarily reduce road emissions, like last-mile transportation and micro-mobility (i.e. electric bike or scooter rideshares can reduce emissions of driving short trips) and in helping partners choose manufacturing locations that can minimize emissions due to shipping.

**Who within a company has the position to make sustainability a reality? As a designer, I sometimes find that sustainability is difficult to broach with clients and higher-ups. What do you do as a company to give voice to those who might not currently have the power to make the real change happen?**

The answer to this is complex - you need key stakeholder buy in to make big changes a reality, but it requires engagement through the entire team to take the vision to reality.

We are working to incorporate sustainable design considerations into our standard design process, to ensure it is another factor that is included in all design decisions, alongside cost,

performance and time to market. This helps to remove the barrier to starting the conversation about this, as we build in these considerations to every step of the process.

## **In Marketing - How can we make our product worth influencing?**

Sustainability is quickly becoming a customer focus. Being able to market that a product meets a particular sustainability certification can be a huge marketing boost!

## **How do you improve sustainability during the prototyping phase?**

It's important to keep an eye on the scale of your impact. While it might feel super unsustainable to throw away 3d printed parts...throwing away one set of protos is vastly superseded by, say, a reduction in part size that could affect thousands of units. That said, there is starting to be biodegradable PLA filament on the market, or accepting a high percentage of regrind for molded parts that won't be life tested could be useful, or using electronic prototypes with parts that can be reused are all good approaches

**It would be great to get some insight into the relative environmental impact of common design decisions for consumer products. I.e. is it more sustainable to use one thick-walled plastic part or two thinner walled parts? How does the environmental impact of formed sheet metal parts compare to injection molded plastic vs extruded aluminum? How can products be designed to minimize the size and impact of packaging?**

You can email [sustainability@synapse.com](mailto:sustainability@synapse.com) and we'd be happy to talk through those specifics. Like so many things, it depends on your use case, scale, product lifetime, end-of-life processes, along with other factors

## **How do you measure the success of the sustainable measures in products?**

In order to measure success, you need a metric to compare against. We recommend starting from the top. Understand your business case and objectives for sustainability, then narrow down

to specific product requirements that you can verify against late in the design process. For example, in order to meet global sustainability standards your company may create carbon emission targets, which can then be broken down to specific product requirements to meet this overarching goal.

**Other than GHG emissions and water use, what are some key metrics that design engineers should try to decrease?**

Human toxicity is another key metric, as is environmental damage due to resource extraction.

**If my company is not ready to invest in LCA software is there any reason why I should stay away from free LCA tools such as openLCA.org ?**

Free LCA tools can be challenging in that the quality of the data that powers them is often low or unknown, which can affect the quality of your results. They are still worth using, but you should be aware of the limitations on the accuracy of results. The time spent working out how to use some of the less user friendly free LCA tools can also be significant! That said, take a look at [upintheir.cambridgeconsultants.com](http://upintheir.cambridgeconsultants.com) for a very limited, but user friendly, tool that can give an idea of the areas of your product that are contributing most significantly to CO2 emissions.

**There is no technical reason products and business models cannot be inherently sustainable. What do you think the biggest challenges are to us getting to this stage? Culture, regulation, price sensitivity....?**

One of the biggest hurdles for sustainable design is in education and understanding the business case for it. Oftentimes it will involve time and investment in the short term, but can more than payoff for itself in the long term.

## **What are the benefits of LCA and how can businesses run them affordably?**

LCAs allow you to identify hot spots in a product life cycle to find ways to reduce the impact of the system or product. They provide another perspective on your product that can stimulate new innovation.

Unless the LCA is required for publishing data, you can run LCAs yourself to inform design decisions at a much lower cost, than if you are looking to meet specific standards for publishing and declaring results.

## **How do you identify hotspots of negative environmental impact across your product supply chain? (in an affordable way!). And what can you do to reduce these?**

A life cycle assessment is very useful for identifying hot spots. Many LCAs can be done in a day, but sometimes collecting the data to put into them takes some time.

Reducing negative environmental impacts is something to be considered on a case by case basis, but often creative redesign, considering alternative product use, considering energy consumed and creating detailed user stories can be helpful. In the product supply chain specifically there are often opportunities in efficiency improvements, that can reduce material and energy use, reducing impact as well as costs. You can also choose supply chain partners carefully who source material and energy from more sustainable sources.

## **The role of LCA and any tradeoffs between non-toxic, low-carbon, and water efficient product attributes.**

LCA is a tool for taking a holistic look at the sustainability of a product, and many tools incorporate human toxicity, carbon footprint, and water usage. It is important to choose your LCA tool and assessment method based on which attributes you're most interested in, you can get results in one, some or all of these areas. Furthermore, you will need to consider how you weight these various factors relative to one another to measure against your sustainability objectives.

**Is LCA enough or are additional certifications needed/desirable?  
Whats the pay back time and value?**

LCA is only a tool, and does not ensure that a design is good. It will show the environmental impact of a product throughout its lifetime. For the design process an LCA is a good tool to help make more sustainable design decisions. Additional certifications or product standards can help guide best practices, and address some issues not always captured in an LCA, such as the social sustainability of your supply chain.

In terms of pay back time and value, it all depends on the use case and is nearly impossible to quantify. Additional considerations beyond the direct economic impact need to be considered, including getting ahead of regulation, meeting changing consumer preferences, and mitigating for sustainability-related business risks.

**What kind of jobs are available for engineers that want to help industry leaders improve sustainability of their products? If I have a product that I want to make more sustainable, what steps do I take, and who do I hire/what company do I reach out to?**

This is a growing area! More and more companies have whole groups focused on business sustainability.

To make a product more sustainable, you will want to engage on a number of levels. Consider everything from the business model innovation through the material selection for specific parts. There are consultancies that focus specifically on innovation in the sustainability area, such as EarthShift, as well as product development consultancies who have a broader scope but capabilities in sustainability, such as Synapse. Look for specific capabilities in the area of sustainability, and how they incorporate it into their product development process.

**What steps did you take to integrate sustainable design into your product and technology development process? We provide seed money (IRAD) for multiple projects under our Sustainable Design Program and also introduced our advanced technology team to bioinspired design.**

Yes, we love biomimicry! We've done trainings on the Natural Step, biomimicry, LCA techniques, and sustainable design. We also hosted an emerging sustainability expert in our office for a period where we could do mutually beneficial education. In our ebook you can see many more of our resources, we've pulled together pieces from across the sustainability field and overlaid it onto a standard product development flow.

### **What claims CPG companies want to have on their packaging?**

More sustainable packaging is definitely becoming a high priority topic. There are many claims that can be made on packaging, including the amount of recycled content used, or that it is biodegradable (which isn't a protected term and therefore does not actually mean anything), or compostable (which does mean it will break down in industrial composting facilities). For many companies the claims they want to put on the packaging will reflect the preferences of their consumers, driven from consumer research.

To have the greatest impact you want to minimize or remove your packaging completely. There are novel examples where the packaging is used as part of the product in operation, or new innovative business where premium packaging is used, but then returned, cleaned and reused (e.g. Loop).

### **What are the new innovations in package materials for consumer products (other than bio plastic and recycled plastic) that still maintain the same characteristics of plastic (i.e good barrier, moldable, recyclable etc. )?**

Like we said in the panel, plastics are a good option for many reasons, but there are many places where they aren't the only answer. Do you really need the same exact characteristics as plastic? A "5 whys" exercise may be useful in investigating, e.g. 'why does it need to be moldable?' We once came across an example where the packaging actually functioned as part of the device, and detergent can now come in dissolvable film packets. A fresh approach may help you get away from too tight constraints.

### **What can be done to help sustainability of products which are inherently single use due to standards & regulations (e.g. medical devices)**

For highly regulated devices, there are still ways to reduce impact, although you may need to be open to higher level innovation! Consider ways to reduce the impact of the disposable portion - perhaps through new alternative materials, reduced mass or avoiding it all together. Some thoughts: Are there opportunities to re-use the high impact portions of the device and only have a small piece be disposable? Are there alternative ways to meet regulations, sterilization for example? Consider the user stories, and end-of-life for these products. How can you recapture, re-process, or recycle materials and components?

In doing this exercise, it is important to evaluate the impact of alternative solutions to ensure you don't introduce new high impact materials or processes.

**How to deal with entrenched interested by big fossil fuel companies. We have a start-up that creates fully biodegradable poly-bags. We've had some interest but our competitors are "biodegradable" plastics which are never disposed of correctly and so don't fulfill their function, created by the billion dollar fossil fuel company. Is legislation the best way forward? or try with smaller suppliers and grow to larger multi-nationals?**

Competition is a strong market factor and often a challenge, especially when many sustainable products start out being much more expensive than similar products in the market. First, it can be helpful to identify situations or user stories in which your unique product offering is essential, which can help drive discussions about business models and scale. Second, there has been good success with local governments lately, many banning single use plastics, so it seems like you could seriously consider how to get into legislation (once the financial trade offs of lobbying are understood).

**Do you see the future of sustainability coming more from product recycling (and reusing recycled parts for current production) or sourcing materials in a different way?**

For many products, collecting and manufacturing new materials is the biggest driver of its environmental footprint. Regardless of how this is done, a huge amount of resources go into the process. Finding ways to create a circular economy, will provide the biggest opportunities for a more sustainable future.

## **How do you balance the creation of new products without adding to the waste stream?**

There are a few things you can do to reduce waste. The first is designing for longevity. If you create a device that lasts double as long, that's half as much waste. You can also design for modularity and disassembly to allow re-use of high impact components or materials. It's a cliché, but deeply considering every corner of the reduce - reuse - recycle triangle may allow you to find creative ways to do all three in one product. It's not going to completely balance it out, but it can mitigate it. (Also, we do talk more about shifting business approach to more circular methods to get away from this more completely in our ebook. But it's often hard to do in established companies.)

## **- What decision-making tools do you use to analyze impact of a product or proposed product improvements?**

## **- How can manufacturers and product developers help support investments in recycling and circularity infrastructure?**

## **- What tools do you use to help educate consumers and end-users about product reuse, recycling, etc?**

We've said this a lot, but LCA is really key to analyzing impacts

Open communication and collaboration between manufactures and local EOL service providers is key to reaching true circularity of materials. This can involve understanding current challenges at the EOL provider (e.g.: materials of concern, contamination rates/hotspots) and how design decisions at the manufacturer could affect EOL operations (e.g.: new materials, material stackups). Once a clear line of communication and baseline is established, the necessary infrastructure requirements to support responsible product recycling should be more clear.

Customer participation in collection of EOL products is the first major step in any recycling or circularity initiative. There isn't a silver bullet that will resonate with everyone, so it is important to do your due diligence to understand what messaging might be effective for your diverse customer base. There are some great examples out there of industries with high recycling rates

such as Patagonia or even municipal recycling in Germany. The goal is to find a way to inspire customers and drive towards the most convenient solution to increase participation.

**What are the first steps one can do to change to more sustainable materials in product packaging, given changes in large companies take time. How to achieve impact sooner?**

This depends a bit on the business approach. The packaging industry has been moving rapidly towards more sustainable options, if you're working with a third-party designer, you can simply ask to hear the latest on their offerings, or you can shop around for the best partners. If packaging is run in house, consider the business case for more sustainable packaging, potentially increased user engagement. Frequently material reduction, creative minimization, or multipurpose packaging will reduce costs (through packaging itself, product, or distribution), which could drive greater business impetus behind the project.

**Are expectations of recycling product components after end of product lifespan realistic?**

This depends hugely on the market and the product. In markets like Europe where disassembly and disposal of batteries is mandated, recycling of plastic product components is a relatively standard practice. Elsewhere, design for disassembly is a consistently evolving field

**Which strategies do you recommend for improve sustainability in products made overseas**

LCAs can help you assess things like places where the energy might be 'cleaner', or sources for certain resources that are less harmful. Assessing and/or auditing the supply chain is also crucial, and getting any information you can about resource extraction and conversion before it arrives at your contract manufacturer is important.

## **When did sustainability become one of the priorities for your company?**

Sustainability has always been a goal for Synapse, but as the field has matured with a more detailed set of technical approaches, and as our clients have been moving their own products and teams to focus on it more, we've been able to engage at a deeper level than before.

## **What is most important to keep in mind when thinking about your product's carbon footprint? What are you doing to decrease your footprint?**

What's most important is that you need to take a step back and see the whole picture. It's not just about a plastic housing, or a cardboard box, one manufacturing process or shipping choice. Many things contribute to the carbon footprint of a product. Some can even be carbon sinks. It's important to understand the whole picture (usually through use of an LCA or other tool) before digging in, to ensure you're optimizing your efforts.