

Pela Case Life Cycle Analysis

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Methodology

Goal and Scope

The goal of this life cycle analysis (LCA) was to measure and understand the key environmental impacts for compostable Pela smartphone cases and compare those impacts to an equivalent, 100% petroleum-based product, to demonstrate the positive impact using less petroleum-based plastic can have on a product's environmental footprint. Additionally, the LCA incorporated Pela's 360 program, a conventional smartphone case take-back initiative, to demonstrate the positive impacts gained from diverting and reusing Pela smartphone cases in Pela's manufacturing process. In order to accomplish this goal, the team at GreenStep and our sister company, EcoBase Solutions, created a tool that will enable Pela to better understand the impact its products have on the environment, and will allow the company to more effectively educate its customers on this impact in a way that is easily understandable.

With the help of the team at Pela, along with research into existing LCA databases, and a review of relevant peer-reviewed secondary research, EcoBase developed this report and an impact calculator for internal use at Pela. EcoBase developed a calculator incorporating all inputs provided by Pela, along with secondary research, with the end result being a value that ranks the impact of each Pela phone case in the areas of carbon dioxide emissions, water, and waste compared to a representative conventional counterpart. The calculator contains every aspect of phone case production, from the growing of the raw plant materials and raw natural resources to the packaging and shipping of finished goods to the end-user (i.e. the customer), and the end-of-life streams for Pela phone cases (landfill, compost, or take-back). Because Pela uses the same base formula for each phone case and only the size and weight of the case is the differentiating factor, the values are easily scalable and require minimal work to add new products.

Unique to Pela is the inclusion of plant material in its base formulation recipe, with its proprietary Flaxstic (trademarked) material composed of a combination of flax shive and bioplastic. The flax component is derived from flax 'shive' and is considered a byproduct of a byproduct in the flax industry. Flax is typically grown for the flax oilseed market. What is leftover after harvesting the seeds, flax straw, is used in the flax textile industry. The remaining material, after the straw is stripped away, is what is known as the shive and is typically discarded by the textile industry. As Pela has reclaimed what is a waste material and incorporated it into the production of its cases, the impacts of flax farming were not included in the system boundary of this LCA.

Also unique to Pela is the use of recycled Pela cases in their manufacturing process. By reclaiming old smartphone cases through their Pela 360 Program, then grinding and reusing them as feedstock, Pela reduces its reliance on conventional, petroleum-based plastic and assists in reducing the overall waste profile of the phone case industry.

A complete LCA identifies potential impacts from global warming, acidification, eutrophication, ozone depletion, photochemical ozone, and primary energy; however, for the purposes of this study and to keep the project specific to Pela's stated goals, the focus is on the aspects that are most relatable to consumers; global warming (carbon emissions), water consumption, and waste created. Two system boundaries were used: one for a single Pela phone case and one for a conventional, fully synthetic phone case. The system boundaries were defined as follows:

System Boundary for Pela Case

Processes Included:

Data from Pela Case, LCA Database Sources & Other Secondary LCA Research

- Raw material production, extraction and transit
 - Flax shive
 - Wheat starch resin
 - Thermoplastic Polyurethane (TPU)
 - Synthetic Silicone Rubber
- Raw material processing and input manufacturing
 - Thermoforming
- Product manufacturing
 - Injection molding
- Packaging
- Transportation (from farm to bioplastic manufacturer, to smartphone case fabrication plant, to distribution centre)
- Transportation from distribution center to customer or retailer
- Product end-of-life

Data from Secondary LCA Research

- Raw materials production (wheat)
- Raw materials transportation
- Transport
 - Air, container vessel, truck
 - From plastic pellet production plant to case fabrication plant to port to distribution centre to retail to customer
- Air transport
 - Online orders to domestic and international market
- Warehousing at distribution centre
- End of life - landfill, compost, or take-back program

Processes Not Included

- Flax farming

Environmental Inputs and Outputs

- Inputs: raw materials, water, energy
- Outputs: kg CO2e (carbon dioxide equivalent), Litres water consumption, kg waste disposal/recycling

Impact Assessment

The life cycle impacts that we sought to measure were:

- Tonnes (kg) CO2e
- Kilotres (L) water
- Tonnes waste to landfill, recycled or composted

Functional Units

- 1 Pela Phone Case
- 1 Conventional Phone Case
- 100,000 Pela Phone Cases
- 100,000 Conventional Phone Cases

Methodology

EcoBase has conducted a cradle to grave LCA for one Pela phone case and compared it with a similar, conventional counterpart. Because Pela uses the same base recipe of components for all of its cases, the results of the LCA can be extrapolated for the entire product line, changing only the weight and dimensions of the phone case in question.

For the purposes of this LCA, EcoBase defined 'cradle' as the raw material creation phase, with the exception of the flax shive component of Pela's formulation. EcoBase defined 'grave' as the end-of-life phase, i.e. landfill, compost, or a take-back program.

The LCA consists of **seven phases** including raw material production, transportation of raw materials to bioplastic pellet manufacturer, bioplastic pellet manufacturing, transportation to case manufacturing plants, packaging, transportation to distribution centres, distribution, and end of life.

Pela provided EcoBase with information on its manufacturing process, including the base ingredients for its case formulation, as well as locations for each phase of its manufacturing process, from raw flax shive procurement, to bioplastic pellet production, to manufacturing and distribution. This information enabled EcoBase to determine carbon emissions, water and freshwater consumption values for the raw materials used in Pela's phone case formulation. Similar work was done to construct a profile for a fully petroleum-based phone case.

EcoBase compared a Pela phone case against its conventional counterpart using the same criteria: manufacturing, transportation, warehousing, and end-of-life were all included in the system boundary. To better understand the impact on a case-by-case basis, the weight of each case was used as a differentiating factor. Three factors distinguished the Pela case from its conventional counterpart during the LCA process: its inclusion of bio-based content in the case itself, one of its manufacturing facilities being located in Saskatoon, Canada, as well as the packaging of its products.

Assumptions

In order to quantify the positive impact Pela has on the environment, it was necessary to select a similar, *conventional* (i.e. 100% petroleum-based) smartphone case of equal shape and size to compare its impact against. The conventional counterpart was passed through the same system boundary processes with the obvious omission of the plant-based component.

The following assumptions were made when comparing Pela Case and conventional smartphone cases:

Materials

- Fossil fuel-derived thermoplastic polyurethane (TPU) and synthetic silicone rubber vs. plant-based equivalent (Flaxstic)
- Because Pela Case is using flax shive, which is a byproduct of the flax oil and flax fibre manufacturing process, EcoBase has not included the production of flax in this LCA. The “cradle” in this case is the point at which the flax shive arrives at the biopolymer production facility in the USA.

Manufacturing/Packaging/Shipping

- Cases manufactured in China for conventional, vs. China and Canada for Pela cases
- Cases individually wrapped in plastic boxes for conventional, vs. FSC-certified kraft paper and reinforced flute for Pela cases

Waste

- Because there is little waste during the manufacturing of a smartphone case due to “sprues” or byproducts from the injection-molding process being recycled back into the manufacturing process, wastage was assumed to occur at the post-consumer phase of the life cycle. EcoBase assumed the following:
 - 45% of Pela Cases go to landfill
 - 50% are composted
 - 5% are returned via the Pela 360 Program
- EcoBase assumed 100% wastage at landfill for the conventional counterpart.

Limitations

This LCA calculator includes all aspects of the phone case production process including transportation between facilities and delivery to warehouse within this LCA calculator (i.e., cradle-to-grave). Because there is a wide variety of information on bioplastic manufacturing, both in alternative LCA calculators and peer-reviewed secondary sources, we have, where possible, worked to compare similar criteria. With this in mind, we have compiled a data set with the following limitations:

- Road, Ship and Air transportation were standardised to:
 - Road 2,300 km
 - Ship 12,000 km
 - Air domestic 2,300 km
 - Air international 8,600 kmfor primary source (cradle), manufacturing and distribution. This assumption was applied to all sources, Pela and conventional, as a conservative approach to standardising global supply chain routes.
- Pela ships the majority of its phone cases directly to the end user, bypassing the retail phase of the supply chain.

What sets Pela cases apart from conventionally-made smartphone cases?

- The use of proprietary bioplastic: 40% bio-based content and 60% non-renewable feedstock.
- Diverting flax shive from the waste stream and giving it new life in the form of a durable good.
- Recycling Flaxstic sprues during the manufacturing process, resulting in little to no manufacturing waste.
- Choosing to use FSC-certified and recycled paper content in all of its packaging.
- Member of 1% For the Planet; portions of a customer's purchase towards a new Pela case go to this organization, which funds global grassroots efforts aimed at protecting and preserving the planet.
- Educating customers on the impacts of plastic pollution in the ocean.
- Encouraging customers to compost their case at the end of its life.
- The Pela 360 take-back program wherein Pela sends each of its new cases to customers with a sleeve to return their old, conventional phone case. Pela then takes these cases and grinds them down, to incorporate into new Pela cases.
- Creating educational campaigns for each of its phone cases, including awareness-raising campaigns for climate change, bees, elephants, penguins, and polar bears, sea turtles, sharks, and whales.

Overall Impact

Pela's stated goal is to keep one billion pounds of waste from ever being created. To accomplish this goal, they "create everyday products without everyday waste." Their smartphone cases are composed of a combination of materials that are both plant-based and conventional, including materials derived from flax and other plant-based sources. While there is a percentage of petroleum-based plastic in each case, the formulation of the bioplastic enables it to be broken down in a home or industrial-type composter. With the Pela 360 Program old Pela cases become feedstock for new Pela cases. Additionally, because of the quality and durability of the finished product, a single case is able to maintain its strength and shape, increasing the longevity beyond that of a standard, conventionally-produced smartphone case.

Figure 1 shows the reduction in carbon, waste and water associated with purchasing a Pela Case (light green) and participating in the Pela 360 program (dark green) compared to a conventional (generic) phone case.

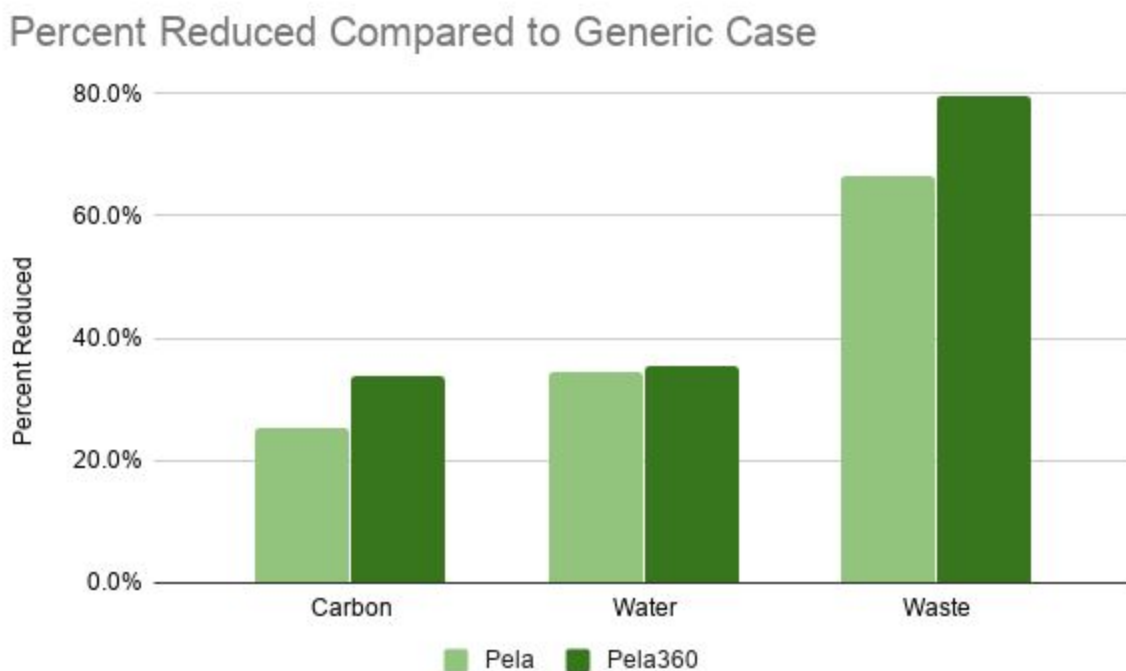


Figure 1. Pela and Pela360 reductions in carbon, water and waste compared to a generic phone case

Based on the LCA calculations and comparing side-by-side, the impact of Pela Case on the environment, when compared to that of a conventional case is shown in table 1 and Figure 2.

Table 1. Head to head comparison of 100,000 Pela cases versus 100,000 conventional phone cases

Phone Case	Tonnes CO2e	Kilolitres Water	Tonnes Waste
Pela	150	773	3.5
Conventional	204	1,148	14.4

Pela vs Conventional

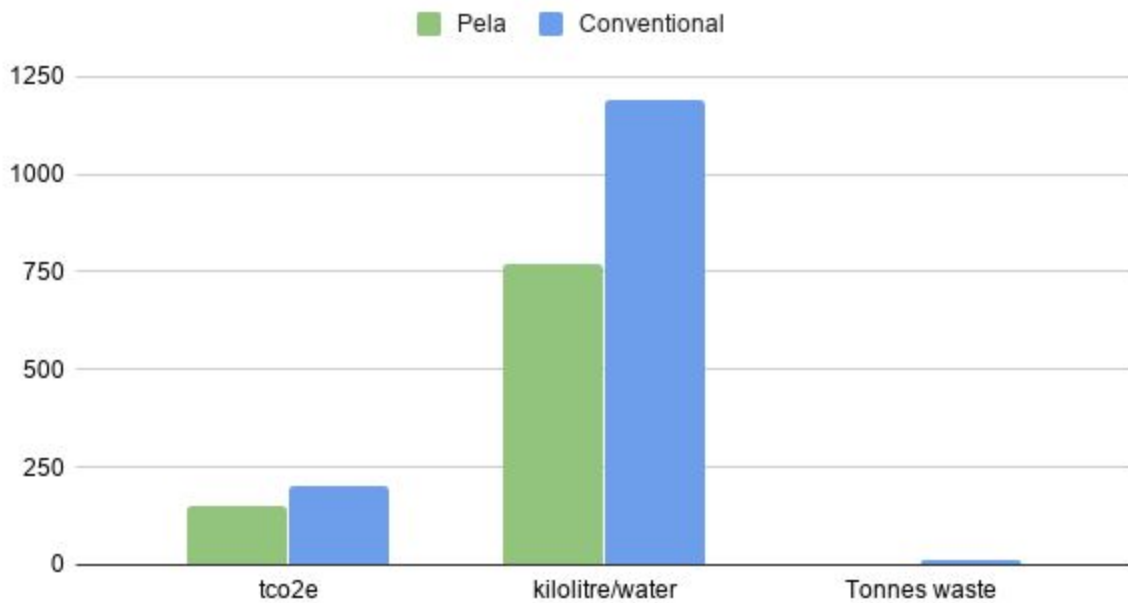


Figure 2. Head to head comparison of 100,000 Pela cases versus 100,000 conventional phone cases

Table 2. Head to head comparison of individual iPhone XR Pela case versus a conventional iPhone XR case. The ECO-Score is the weighted total of the three metrics scaled out of 100. The lower the ECO-Score the lower the impact.

IP XR	kg CO2e	Litres Water	kg Waste	ECO-Score
Pela	1.55	7.74	0.037	25
Conventional	2.11	11.9	0.146	42

Further to Pela's stated mission, not only are they creating products with longer lifespans, composed of higher-quality materials, but they are also educating their customers about the perils of plastic pollution in the ocean and other critical issues, including the plight of various animal species, climate change, and coral reef health, to name a few. Pela produces limited-edition case designs specifically for these campaigns, enabling them to educate through consumerism and raise awareness about these issues.

Pela is a member of 1% For the Planet, an international organization to which members contribute 1% of their annual sales, the proceeds of which are contributed towards campaigns and organizations dedicated to bettering the planet. Some of Pela's outreach efforts have included partnerships with Me to We; the Environmental Media Association; Save the Waves; and Surfrider Foundation.

"Purchasing a Pela phone case reduces carbon emissions by 25%, water consumption by 35% and **waste production by 67%**, compared to a generic phone case."

While this LCA project cannot estimate the positive impact that this education and awareness raising has had on societies around the world, it has been demonstrated that purchasing a single Pela phone case, regardless of the campaign it is associated with, will reduce carbon emissions by 24.6%, water consumption by 34.6% and waste production by 66.6%, when compared to a conventional phone case. If the Pela 360 program is taken into account, carbon emissions are reduced by 33.8%, water consumption by 35.4% and waste production by 79.6%

"Participating in the Pela360 program reduces carbon emissions by 34%, water consumption by 35% and **waste production by 80%**, compared to a generic phone case."

Recommendations

The issue of plastic pollution in the ocean is one that has grown tremendously over the last decade. Consumers are aware, now more than ever, of the impact their purchases have on the planet, and are seeking to engage with consumerism in a different way. Pela offers a product that addresses this need, while educating its global market and shifting awareness about critical issues facing the planet. At its core, Pela is a waste-diversion company. By creating products composed of higher-quality, compostable materials, they significantly reduce the amount of conventional plastic ending up in landfills around the world, thereby reducing the overall waste, water and carbon footprint of their products.

The path to zero involves intentional consideration at each step of the lifecycle; raw material sourcing, manufacturing, distribution, customer-use, and end-of-life phase. As Pela grows, careful attention should be paid to confirm that each step along the full lifecycle of its compostable smartphone cases is working towards the goal of a fully-circular product. To continue down this path, to reduce and neutralize the impacts of Pela products, and to ensure accuracy in reporting, the following steps are recommended:

- ❑ Set ambitious goals with timelines and targets for waste and carbon reduction, “the path to zero,” as well as customer composting and recycling. Communicate these publicly.
- ❑ Focus on accelerating the Pela 360 program; tell the waste diversion story to encourage participation as findings of this LCA are communicated to the customer base.
- ❑ Gather robust data metrics on the program and verify the amounts of material that supplants primary petroleum-based plastics.
- ❑ Conduct customer surveys to gain a better understanding of what percentage of cases are composted by customers at the end of their usable life.
- ❑ Obtain more customer data for end of life composting rates. Most products in North America are sent to the landfill at the end of their life, and the number of jurisdictions globally that accept mixed organics is very limited.
- ❑ Explore neutralizing conventional plastic consumption through plastic offsets.

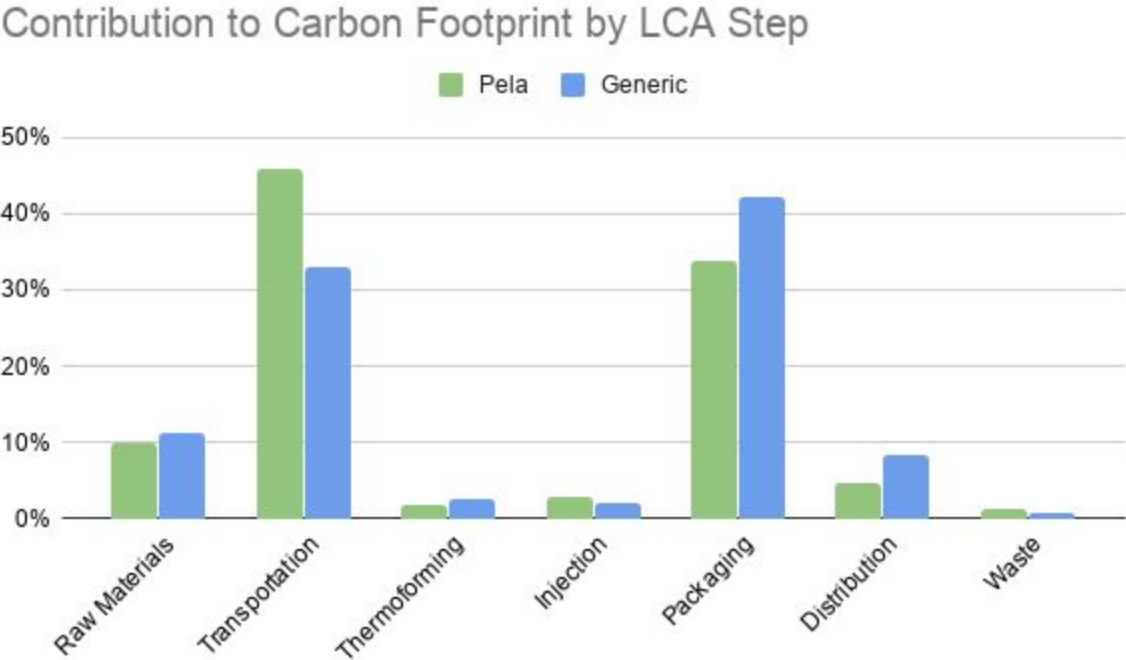


Figure 3. Carbon contribution by LCA step

The largest impact that was discovered through this LCA project was the carbon footprint of transportation: both transportation of raw goods to manufacturing facilities, as well as finished product to distribution centres, and from distribution centres to the customer (Figure 3).

- ❑ With transportation accounting for 46% of the carbon footprint, identify opportunities to streamline transportation routes and supply chain to reduce the distances travelled to lower the carbon footprint.
- ❑ Neutralize all lifecycle carbon emissions that can/have not been reduced or eliminated, through the purchase of carbon offsets.

Much of Pela's manufacturing takes place in both Saskatchewan, Canada and China. As of December 2019, Pela Case will be moving its Canada operations to Kelowna, British Columbia, while continuing to manufacture the bulk of its cases at its China plant. The move to British Columbia will result in lower carbon emissions, due to the fact that the vast majority of power produced in BC comes from renewable hydroelectric sources.

- ❑ We recommend that Pela work with its Chinese manufacturers to learn about, encourage, and support any plans to shift to renewable power sources.

Because bioplastics have historically been a contentious issue, as both their material composition and ability to truly biodegrade have been called into question, it is imperative that Pela remain open and transparent about its proprietary, Flaxstic material. This LCA goes a long way in confirming that Pela is on the right track and that its bio-based content truly does have a lower impact than a similar, petroleum-based product.

It should be noted that within the LCA, water consumption and carbon emissions values for wheat were quite high and this is presumably because of agricultural growing practices in the United States, where the data was pulled from. Additionally, because wheat is grown as a food crop and is not a by-product of any other industry, its impact within the boundaries of this LCA contributed to the higher values.

Interpreting Results

The data shows that Pela smartphone cases are lower impact products across all three metrics compared to conventionally produced smartphone cases. Pela is shown on average, to produce 26% less CO₂e, consume 33% less water and produce 76% less waste than their conventional counterparts. These reductions amount to saving 54 tonnes of CO₂e from being emitted to the atmosphere, 416 kilolitres of water and 11 tonnes of waste per 100,000 cases.

Phone Case	Tonnes CO2e	Kilolitres Water	Tonnes Waste
Percent reduction	26%	33%	76%
Total saved	54	416	10.9

Conclusions

As the issue of plastic pollution in the environment continues to grow, the need for alternative materials will continue to grow along with it. Bioplastics offer companies a way of continuing to manufacture durable goods by either incorporating a percentage of plant-based materials into their products, or fully switching to 100% biodegradable materials. Bioplastics also create new resource streams from otherwise wasted agricultural by-products or excessive crop yields (e.g, corn). When once this material was subject to skepticism, the bioplastics and bioresin market are gradually gaining customer acceptance. With further technological iterations, Pela will be well-positioned to capture this market with its current and future product lines.

This LCA clearly demonstrates the positive impact on the environment that results from replacing a portion of conventional, petroleum-based material with plant-based components. According to its website, approximately 528,112 consumers have switched from conventional, petroleum-based smartphone cases to compostable, Pela cases. With the smartphone market at 3.2 billion current users and growing, Pela has the potential to truly shift the market towards more sustainable alternatives, which will result in lower carbon emissions, less water consumption, and less waste in already overcrowded landfills.

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Appendix A

Phone Case	Saskatchewan Manufacturing			
	Carbon kg CO2e	Water L	Waste kg	ECOSCORE
IP SE	1.432	7.681	0.033	34
IP 6/7/8	1.456	7.681	0.033	35
IP PLUS	1.465	7.683	0.033	35
IP X	1.531	7.699	0.036	36
IP XR	1.494	7.690	0.035	35
IP XS	1.550	7.704	0.037	36
IP XSMAX	1.503	7.692	0.035	35
IP XI	1.653	7.730	0.041	38
IP XIMAX	1.550	7.704	0.037	36
IP XR2019	1.653	7.730	0.041	38
PX2	1.550	7.704	0.037	36
PX2XL	1.484	7.688	0.034	35
PX3	1.578	7.711	0.038	37
PX3XL	1.475	7.685	0.034	35
PX4	1.606	7.718	0.039	37
PX4XL	1.494	7.690	0.035	35
S10	1.540	7.702	0.037	36
S10+	1.540	7.702	0.037	36
S10e	1.550	7.704	0.037	36
A50	1.494	7.690	0.035	35
A40	1.606	7.718	0.039	37
Note 9				
Note 8	1.512	7.695	0.035	36
S9	1.606	7.718	0.039	37
S9+	1.512	7.695	0.035	36
S8	1.559	7.707	0.037	36

S8+	1.465	7.683	0.033	35
S7	1.522	7.697	0.036	36
P20Lite	1.494	7.690	0.035	35
P30	1.503	7.692	0.035	35
P30Pro				

Phone Case	Pela Kelowna Manufacturing			
	Carbon kg CO2e	Water L	Waste kg	ECOSCORE
IP SE	1.449	7.710	0.033	24
IP 6/7/8	1.439	7.710	0.033	24
IP PLUS	1.450	7.713	0.033	24
IP X	1.528	7.736	0.036	25
IP XR	1.483	7.723	0.035	24
IP XS	1.550	7.743	0.037	25
IP XS MAX	1.494	7.726	0.035	24
IP XI	1.673	7.779	0.041	26
IP XIMAX	1.550	7.743	0.037	25
IP XR2019	1.673	7.779	0.041	26
PX2	1.550	7.743	0.037	25
PX2XL	1.472	7.720	0.034	24
PX3	1.584	7.753	0.038	25
PX3XL	1.461	7.717	0.034	24
PX4	1.617	7.763	0.039	25
PX4XL	1.483	7.723	0.035	24
S10	1.539	7.740	0.037	25
S10+	1.539	7.740	0.037	25
S10e	1.550	7.743	0.037	25
A50	1.483	7.723	0.035	24
A40	1.617	7.763	0.039	25
Note 9	1.082	7.605	0.020	20
Note 8	1.506	7.730	0.035	24
S9	1.617	7.763	0.039	25
S9+	1.506	7.730	0.035	24

S8	1.561	7.746	0.037	25
S8+	1.450	7.713	0.033	24
S7	1.517	7.733	0.036	24
P20Lite	1.483	7.723	0.035	24
P30	1.494	7.726	0.035	24
P30Pro	1.082	7.605	0.020	20

Phone Case	Pela China Manufacturing			
	Carbon kg CO2e	Water L	Waste kg	ECOSCORE
IP SE	1.615	7.697	0.033	36
IP 6/7/8	1.615	7.697	0.033	36
IP PLUS	1.628	7.700	0.033	36
IP X	1.722	7.722	0.036	38
IP XR	1.671	7.709	0.035	37
IP XS	1.749	7.728	0.037	38
IP XSMAX	1.686	7.712	0.035	37
IP XI	1.896	7.762	0.041	40
IP XIMAX	1.757	7.728	0.037	38
IP XR2019	1.898	7.762	0.041	40
PX2	1.757	7.728	0.037	38
PX2XL	1.659	7.706	0.034	37
PX3	1.789	7.737	0.038	39
PX3XL	1.647	7.703	0.034	36
PX4	1.828	7.747	0.039	39
PX4XL	1.675	7.709	0.035	37
S10	1.736	7.725	0.037	38
S10+	1.738	7.725	0.037	38
S10e	1.752	7.728	0.037	38
A50	1.672	7.709	0.035	37
A40	1.829	7.747	0.039	39
Note 9				
Note 8	1.679	7.715	0.035	37
S9	1.830	7.747	0.039	39

S9+	1.701	7.715	0.035	37
S8	1.764	7.731	0.037	38
S8+	1.633	7.700	0.033	36
S7	1.708	7.719	0.036	37
P20Lite	1.671	7.709	0.035	37
P30	1.683	7.712	0.035	37
P30Pro				

Phone Case	Conventional China Manufacturing			
	kg CO2e	Water L	Waste kg	ECOSCORE
IP SE	2.18	11.87	0.142	64
IP 6/7/8	2.18	11.87	0.142	64
IP PLUS	2.20	11.87	0.142	64
IP X	2.30	11.89	0.145	66
IP XR	2.24	11.88	0.144	65
IP XS	2.33	11.90	0.146	66
IP XS MAX	2.26	11.88	0.144	65
IP XI	2.50	11.93	0.151	69
IP XI MAX	2.34	11.90	0.146	66
IP XR2019	2.50	11.93	0.151	69
PX2	2.34	11.90	0.146	66
PX2XL	2.23	11.88	0.143	64
PX3	2.38	11.91	0.147	67
PX3XL	2.22	11.87	0.143	64
PX4	2.42	11.92	0.149	67
PX4XL	2.25	11.88	0.144	65
S10	2.32	11.89	0.146	66
S10+	2.32	11.89	0.146	66
S10e	2.33	11.90	0.146	66
A50	2.24	11.88	0.144	65
A40	2.42	11.92	0.149	67
Note 9				
Note 8	2.26	11.88	0.145	65

S9	2.42	11.92	0.149	68
S9+	2.28	11.88	0.145	65
S8	2.35	11.90	0.147	66
S8+	2.20	11.87	0.142	64
S7	2.29	11.89	0.145	65
P20Lite	2.24	11.88	0.144	65
P30	2.26	11.88	0.144	65
P30Pro				