LightSpray™ Technology: Innovating Athletic Footwear

Case Study of the Cloudboom Strike 2

Life Cycle Assessment by Vaayu

July 2026

What is LightSpray™ technology?

On has dedicated the past seven years to developing LightSpray™, a new manufacturing technique aimed at revolutionizing On's athletic footwear production.

Now, in the early stages of scaling, this first-of-its-kind technology fabricates an ultralight, single-piece shoe upper through a streamlined, singular process. It eliminates the need for the stitching and bonding typically required in traditional shoe production.

How does LightSpray™ technology work?

Produces a continuous thread

Wraps around a rotating shoe last

A robotic arm layers the material

Creates a LightSpray Cloudboom Strike 2* shoe upper in approximately four minutes

*Depending on the shoe model, the upper spraying time via LightSpray™ technology may vary.

The innovation of LightSpray™ technology

LightSpray™ was developed to revolutionize On's production technique, reducing the product carbon footprint while making the shoe lighter.

1. Simplified supply chain
2. Streamlined manufacturing
3. Eliminated assembly processes
4. Reduced waste
5. Optimized high-performance running shoes

Key findings — Full shoe

A comparison of the Cloudboom Strike 2 and the LightSpray Cloudboom Strike 2 shows that manufacturing the shoe with LightSpray™ technology could reduce cradle-to-grave greenhouse gas emissions:

The most significant potential for reducing carbon emissions comes from using raw materials more efficiently, cutting energy use by simplifying the manufacturing steps, and lowering product weight, which reduces transportation emissions. LightSpray™ technology also considerably lowers material and energy consumption and, most significantly, minimizes waste during production.

These calculations were done for a pair of men's US size 10 shoes with the uppers produced in Zurich for the LightSpray and in Vietnam for the conventional shoe; and the soles produced in China and Vietnam for both shoe styles. The results cover the full lifecycle (cradle to grave) from raw materials to end-of-life.

1.1 kg CO_2e ↓

reduced per pair of shoes compared to conventional production

7.6%↓

reduction in production emissions per pair of shoes with Zurich's current energy mix compared to conventional shoe production

8.0%↓

reduction in production emissions per pair of shoes compared to conventional shoe production if renewable energy is used (Applying Scenario 2 to the LightSpray shoe). Full results on page 15

Global Warming Potential (GWP) Comparison: Full shoe (cradle-to-grave) — Conventional vs. LightSpray™ Product Systems (Baseline)

If renewable energy is used, there is an additional 0.4% decrease in impact within the full life cycle of the LightSpray shoe, bringing the impact of producing a shoe down to 13.51 kgCO_2e.

Key findings — Upper

A comparison of the Cloudboom Strike 2 and the LightSpray Cloudboom Strike 2 shows that manufacturing the shoe uppers with LightSpray™ technology could reduce cradle-to-gate greenhouse gas emissions for the upper (raw material, component processing and assembly stages).

During the LightSpray™ process, the upper processing and assembly happen simultaneously. Thus, only the yellow bar is shown as the component processing stage for the LightSpray Cloudboom Strike 2 upper impact.

These calculations were done for a pair of men's US size 10 shoes with the uppers produced in Zurich for the LightSpray and in Vietnam for the conventional shoe. Extending the scope to include the distribution and end-of-life would still result in a 75.9% reduction.

Upper allocation to the assembly stage is based on a physical metric: the percentage of the upper components' weight relative to the total product weight.

2.2 kg CO_2e ↓

reduced per pair of uppers (raw materials, component processing and assembly) compared to conventional production

78.7% ↓

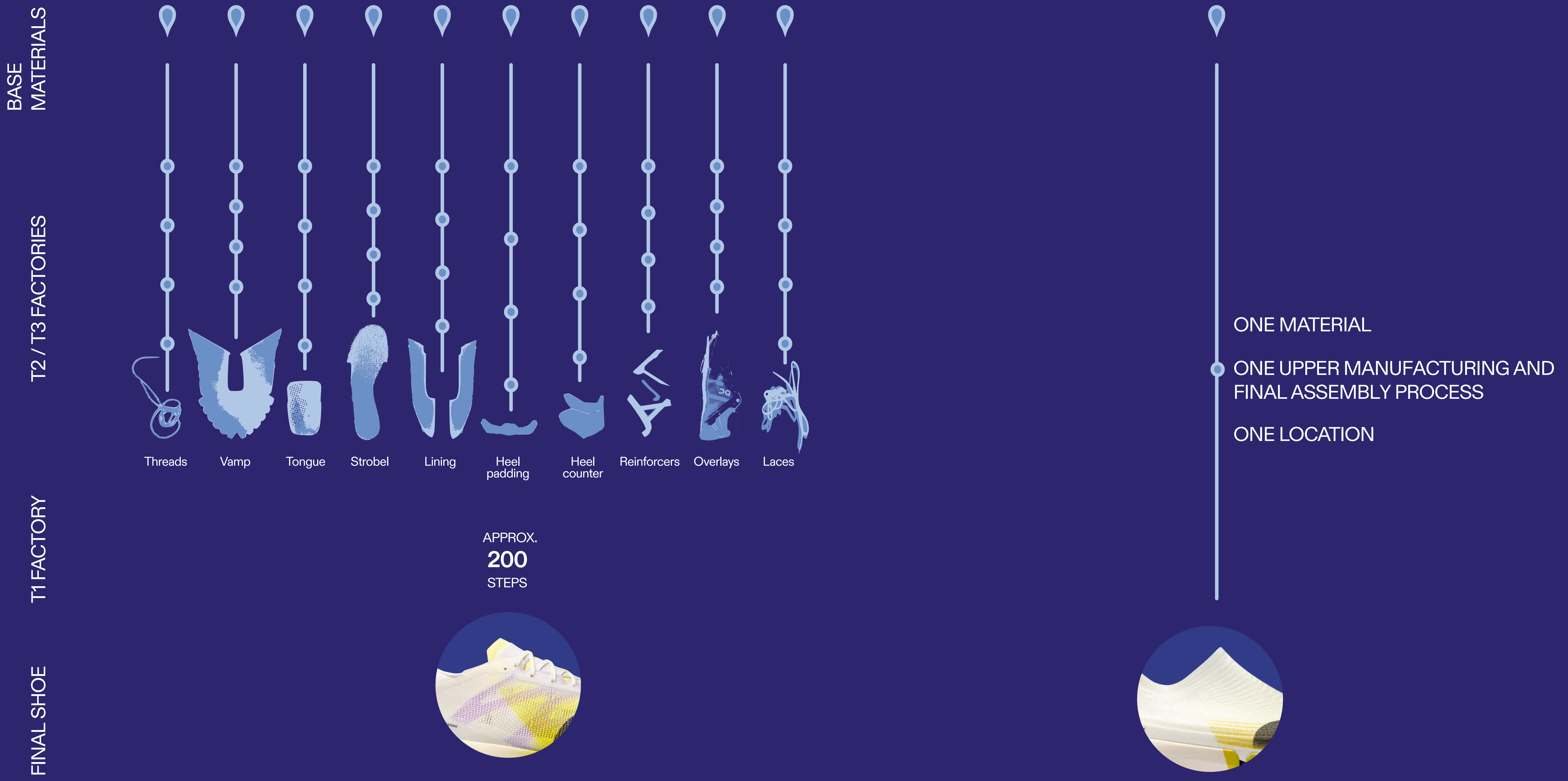
reduction in production emissions for the shoe's upper with Zurich's current energy mix compared to the conventional shoe production

80.8% ↓

reduction in production emissions for the shoe's upper if renewable energy is used, compared to the conventional shoe production (Applying Scenario 2 to the LightSpray shoe). Full results on page 15

Global Warming Potential (GWP) Comparison: Upper (cradle-to-gate) — Conventional vs. LightSpray™ Product Systems (Baseline)

On’s conventional athletic upper manufacturing process compared with LightSpray™ technology



Calculating the potential impact of LightSpray™ technology

This report, conducted by Vaayu on behalf of On, evaluated the environmental impact of LightSpray™ as commercial production expands. The methodology and calculations are based on the Cloudmonster Hyper 3 life cycle assessment study, conducted on the preliminary stages of the LightSpray™ technology. Find the full study here.

The analysis used life cycle assessment (LCA) to compare On's LightSpray Cloudboom Strike 2 shoe, produced using LightSpray™ technology, with On's conventional production technique for the Cloudboom Strike 2 shoe.

Vaayu quantified the potential reduction in carbon footprint (in CO_2e) and delved deeper into the environmental benefits of further optimizing this technology as it scales.

What was calculated?

- A prospective attributional LCA for LightSpray™ technology applied specifically to the LightSpray Cloudboom Strike 2
- A conventional attributional LCA for the existing (non-LightSpray™) technology used in the Cloudboom Strike 2
- A comparative analysis between LightSpray™ technology and the existing approach, considering different scenarios

Functional Unit

The functional unit used to assess the impact of LightSpray™ technology was **one pair of men's athletic running shoes, US size 10**. Using a whole pair of running shoes as the functional unit enabled a full cradle-to-grave* product comparison between this shoe and a conventional shoe.

To assess the manufacturing benefits of LightSpray™ technology specifically for the upper, the functional unit was **adjusted to one pair of men's athletic running shoe uppers, US size 10**. In this case, the results reflect a cradle-to-gate** scope, allowing a targeted comparison with conventional shoe uppers.

Scenarios

In addition to calculating the Baseline, three scenarios were investigated to estimate the impact of LightSpray™ technology. The methodology for each scenario is explained in this section.

Baseline: Comparison between the Cloudboom Strike 2 (Conventional) and the LightSpray Cloudboom Strike 2 (LightSpray™)

The energy emission factor for the upper manufacturing (and consequently, shoe assembly) in Zurich for the LightSpray shoe and in Vietnam for the conventional shoe was assumed. The LightSpray™ process uses the conventional energy mix of Switzerland. Inbound transport was modelled the same way as the Conventional shoe, with only 7% by air freight and the rest by sea and truck.

Scenario 1: Change to 100% Air Freight for Inbound Transport for the LightSpray Cloudboom Strike 2 (LightSpray™)

The worst-case scenario assumed that inbound transport in the LightSpray™ system occurs 100% by air, while transportation for the Conventional shoe system remains the same.

*Cradle-to-grave definition: scope that covers the complete environmental impacts of a product across its entire life, from raw material extraction through manufacturing, distribution, use by the customer, and final disposal or recycling.

**Cradle-to-gate definition: scope that covers all environmental impacts from the extraction of raw materials through to the point the product leaves the factory gate, ready for distribution. It does not include the impacts of transportation to the customer, product use, or end-of-life disposal.

Scenario 2: Change to 100% Renewable Energy for Manufacturing the Shoe's Upper for the LightSpray Cloudboom Strike 2 (LightSpray™)

This scenario, with only a minor change to the Baseline, assumed that the LightSpray™ system uses 100% renewable energy baseline at the LightSpray™ production site, while the energy for the Conventional shoe system remains the same, as it is being produced in a different production location.

Scenario 3 (Theoretical scenario): Changes to Renewable Energy for Manufacturing the Shoe's Upper & the Application of Low-Emission Autoclave Foaming for Manufacturing the Shoe's Bottom for the LightSpray Cloudboom Strike 2 (LightSpray™)

The most optimistic scenario assumes not only that the LightSpray™ system uses 100% renewable energy, but also that the LightSpray™ shoe's autoclave foaming manufacturing stage for the shoe bottom has a lower environmental impact. At this stage, this is a purely theoretical scenario that enables On to test how further optimisations, such as an optimised midsole production process, more efficient production of supercritical gas, a closed-loop system, and reduced defect rates, could change the impact of the LightSpray™ production process.

Main assumptions and limitations

Applicable to both the Cloudboom Strike 2 and the LightSpray Cloudboom Strike 2 (LightSpray™) models:

- Distribution uses two routes, e-commerce and retail stores: the distances and transport modes were based on the PEFCR for Apparel & Footwear.
- Use phase and end-of-life modelled based on the PEFCR for Apparel & Footwear.

Applicable only to the Cloudboom Strike 2 shoe model:

- Laminated components have the following mass split: TPU/PU: 20%, textile 80%.
- Shoe components with a minimal weight contribution were excluded from the analysis (such as threads, webbings, small foams).

Limitations

The limitations of the analysis acknowledge the constraints and challenges that may affect the interpretation and applicability of its findings. These limitations include:

- Primary data regarding autoclave foaming was not available: the emission factor was based on estimates rather than on actual energy-use measurements for this process.
- Production of the robot arm and the infrastructure for the Conventional method were out of scope.
- Further efficiencies that can be gained through scale, once the technology achieves full commercialisation and steady state, were not included in this analysis.
- To take a conservative approach, the potential for higher recyclability of the LightSpray™ product was not included in the end-of-life model.

Life Cycle Impact Analysis

The greenhouse gas estimates from the life cycle inventory were converted to the midpoint indicator value for GWP (in kg CO_2e) using the IPCC 2021 impact assessment method.

The following sections summarise the impact analysis results for each scenario.

Base scenario - Conventional Cloudboom Strike 2

In this section, the Baseline GWP estimates for the Conventional model's product system are provided. Key findings include the following data.

Raw material extraction and processing

25%

The upper materials are the second-highest GWP contributors in this stage, with a GWP of 0.91 kg CO_2e. The add-on materials have an additional GWP of 0.04 kg CO_2e.

The top cloth material contributes to 0.04 kg CO_2e.

The insole materials have a GWP of 0.02 kg CO_2e.

The bottom materials are the largest contributors to GWP in this stage, accounting for 2.67 kg CO_2e.

Manufacturing and assembly

60%

Upper production accounts for 1.48 kg CO_2e and contributes significantly to GWP. The upper assembly accounts for 0.38 kg CO_2e.

Top cloth production contributes to 0.14 kgCO2e.

Midsoles and outsoles component processing account for 6.17 kg CO_2e, which is among the highest impact across all production stages. The assembly stage accounts for 0.64 kg CO_2e.

Packaging

6.5%

Primary and secondary packaging account for 0.96 kg CO_2e, or 6.5% of the total.

Inbound transport

3.4%

Inbound transport contributes 0.51 kg CO_2e GWP.

Distribution

1.6%

The transportation GWP for the boxed pair of shoes from the warehouse was estimated at 0.23 kg CO_2e.

Product use

0.5%

Product-use-phase GWP was estimated at 0.08 kg CO_2e.

End-of-life

2.9%

EOL contributed marginally, with an estimated GWP of 0.43 kg CO_2e.

Upper allocated global warming potential

The GWP specifically allocated to the upper part* is estimated as 2.81 kg CO_2e.

2.81 kg CO_2e

Total global warming potential

14.69 kg CO_2e

The total calculated GWP was 14.69 kg CO_2e.

*The top cloth is a separate component that is not part of the upper.

Base scenario - LightSpray Product Carbon Footprint

Provided in this section is a breakdown of the estimated GWP in kg CO_2e across various life cycle stages of the LightSpray™ product system, from raw materials extraction to end-of-life.

*The top cloth is a separate component that is not part of the upper.

Raw material extraction and processing

22.6%

Upper materials production contributes 0.53 kg CO_2e GWP.

Top cloth material production contributes 0.04 kg CO_2e GWP.

The top/bottom midsole combined accounts for 2.27 kg CO_2e GWP, which has a significant impact on the raw materials stage. On's carbon fibre speedboard is the main contributor to this entire stage. Outsole contributes 0.22 kg CO_2e GWP.

Manufacturing and assembly

46.3%

Upper production and assembly contribute marginally to GWP, accounting for 0.07 kg CO_2e, or 0.5% of the total.

Top cloth production contributes 0.14 kg CO_2e.

Midsoles and outsoles component processing account for 5.77 kg CO_2e, which is among the highest impact across all production stages. The assembly stage accounts for 0.31 kg CO_2e.

Packaging

Primary and secondary packaging are the second-highest contributors to the GWP impact, accounting for 3.20 kg CO_2e, or 24% of the total.

23.6%

The main hotspot is the LightSpray Cloudboom Inner Box component, which accounts for 2.23 kg CO_2e, with the impact driven primarily by its weight.

Inbound transport

1.8%

Inbound transportation, from the assembly site to the warehouse, was estimated at 0.24 kg CO_2e GWP. The short distance between the Swiss production site and the local warehouses reduces the impact of this stage, mainly because of the use of truck transport for European shipments and the central location for American shipments.

Distribution

2.8%

Transportation from the warehouse to the final customer was estimated to be 0.38 kg CO_2e GWP. Road transport is assumed for this stage.

Product use

0.5%

Product use emissions were estimated at 0.06 kg CO_2e GWP.

End-of-life

2.5%

EOL contributes marginally, with an estimated GWP of 0.34 kg CO_2e.

Upper allocated global warming potential

The GWP specifically allocated to the upper part* is estimated as 0.60 kg CO_2e.

0.60 kg CO_2e

Total global warming potential

13.57 kg CO_2e

The total GWP is 13.57 kg CO_2e, about 7.60% lower than that of the Conventional shoe.

Results & Interpretation

Baseline comparison

Baseline: Comparison between the Cloudboom Strike 2 (Conventional) and the LightSpray Cloudboom Strike 2 (LightSpray™)

Based on a functional unit of one pair of men's US size 10 athletic shoes, LightSpray™ can yield an estimated total reduction of 1.12 kg CO_2e for the models investigated in this analysis.

Compared with the estimated unit processes of the Conventional production system (cradle-to-gate calculation), using LightSpray™ can reduce emissions by approximately 78.7% during the manufacturing of the upper part of the LightSpray Cloudboom Strike 2.

The difference in estimated emissions between the two systems is illustrated in Figure 3. Reductions are observed across all life cycle stages, except for packaging and distribution, which are mainly affected by the high packaging weight of the LightSpray shoe version. Specifically, as noted above, LightSpray™ has the potential to reduce emissions associated with upper material production by 2.22 kg CO_2e per pair of shoes (based on the cradle-to-gate scope result allocated to the upper).

This is mainly attributable to the use of approximately 20% less material by weight in this innovative technology compared with the Conventional technology. LightSpray™ uses one material type (TPU) with a top cloth (Polyester), whereas the Conventional system employs more than 10 material types (including fabric blends).

Another reason for the reduction is the LightSpray ™ manufacturing process, which is significantly simpler than the Conventional model's process. While Conventional manufacturing includes many processes, such as yarn spinning, weaving/knitting, and colouring, the LightSpray™ upper has a single streamlined, optimised step to create the shoe upper.

Moreover, when applied to the LightSpray Cloudboom Strike 2, the LightSpray™ technology reduces product weight by approximately 95 grams. This will reduce transportation emissions downstream of the final manufacturing site. Calculation models for the use phase and end-of-life are also weight-dependent, meaning that a lighter product can yield reductions in these stages of the life cycle.

Figure 3: GWP Comparison: Conventional and LightSpray™ Technology Product Systems (Baseline)

Baseline GWP Comparison: Comparison between the Cloudboom Strike 2 (Conventional) and the LightSpray Cloudboom Strike 2

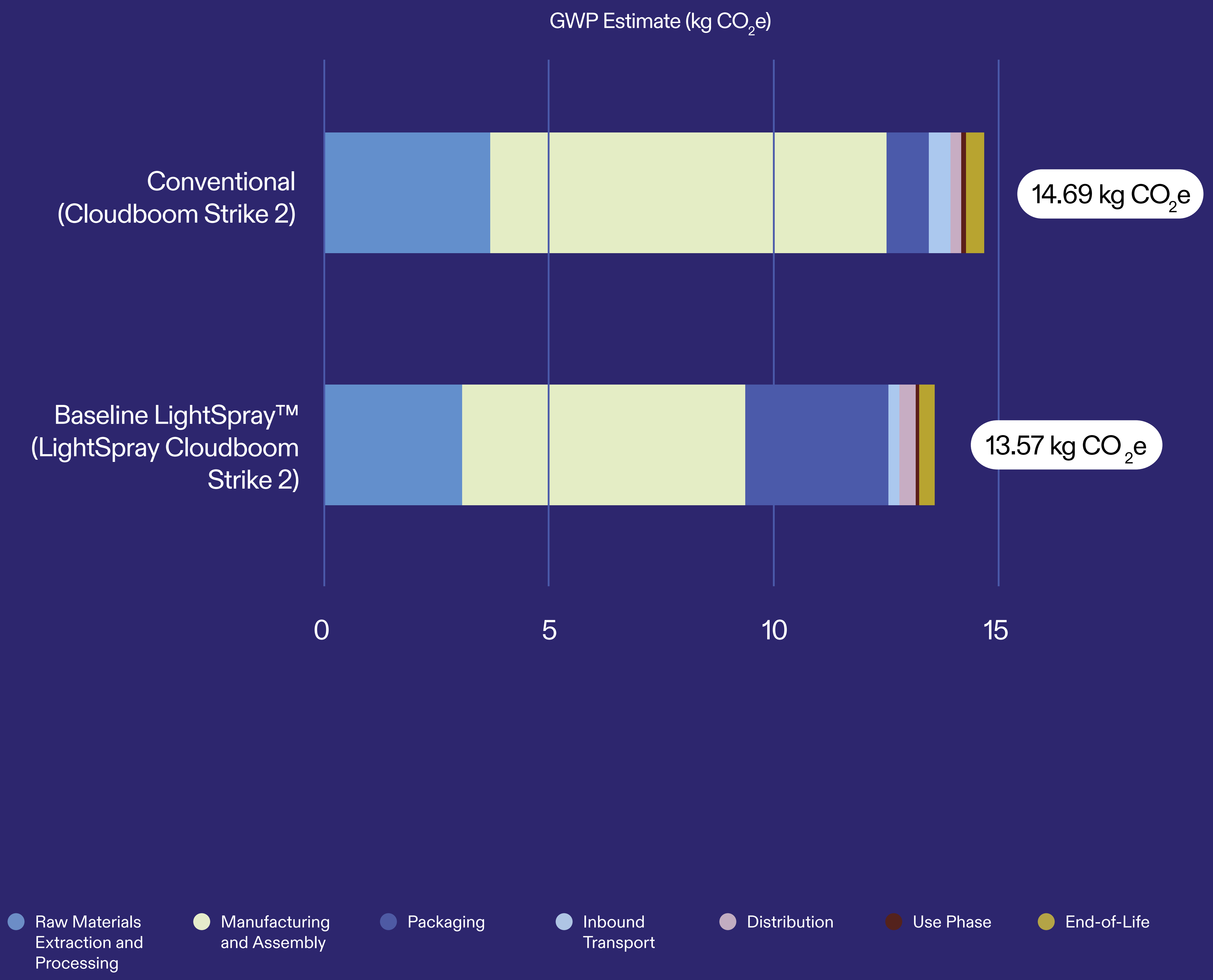
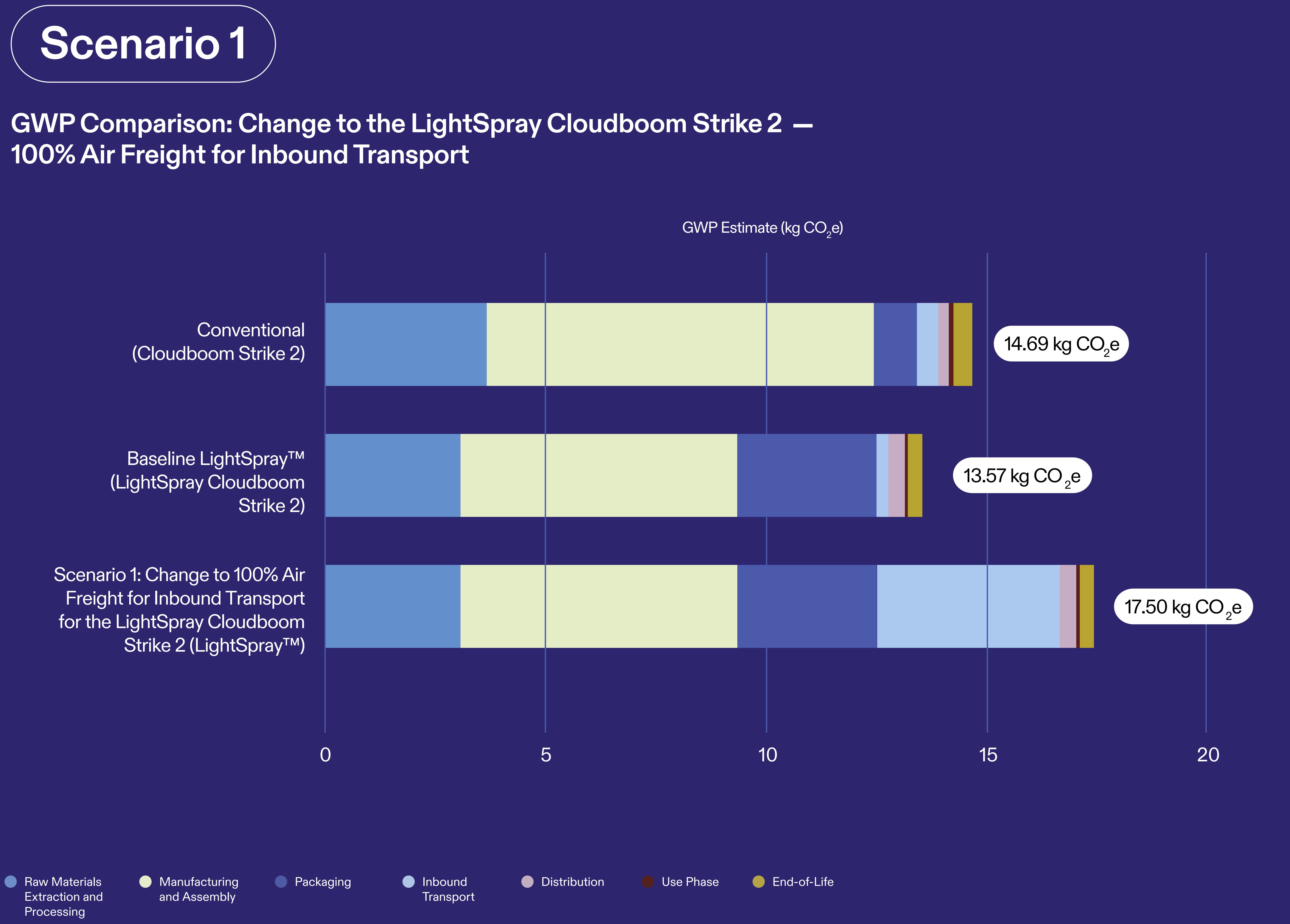


Figure 4: GWP Comparison: Conventional and LightSpray™ Technology Product Systems (Scenario 1)



Scenario Comparisons

Scenario 1: Change to 100% Air Freight for Inbound Transport for the LightSpray Cloudboom Strike 2 (LightSpray™)

In this scenario, the only change is the transportation of the product from the manufacturing site to On's logistics distribution sites in Asia, Europe, and North America. In this scenario, all transportation is conducted exclusively by air. Results clearly demonstrate how logistics can play a crucial role in a product's total footprint and the significant climate impact of air freight transport. The total climate change result of the LightSpray Cloudboom Strike 2, manufactured with LightSpray ™ technology, is now 19% higher than that of the Conventional shoe. Inbound transport emissions increase by 3.93 kg CO_2e, a very considerable increase. In Scenario 1, emissions from inbound transport account for 24% of the product's total footprint, compared to only 2% in the Baseline.

Scenario 2: Change to 100% Renewable Energy for Manufacturing the Shoe's Upper for the LightSpray Cloudboom Strike 2 (LightSpray™)

In this scenario, the only difference relative to the Baseline is that the LightSpray™ technology is operated using 100% renewable energy. For this scenario, a realistic energy mix for Zurich was modelled, accounting for the country's main renewable energy technologies. Emissions from processing the upper of the LightSpray Cloudboom Strike 2 decreased from 0.07 to 0.01 kg CO_2e, representing a 86% reduction. The product's total emissions were reduced by 0.4%. Therefore, the use of renewable energy alongside this innovative manufacturing technology has the potential to achieve further emissions reductions when compared with On's Conventional shoe manufacturing. If we compare the production of the LightSpray Cloudboom Strike 2 upper alone, including materials, to that of the Conventional shoe, there is a 81% reduction in emissions for this component.

The electricity grid mix in Switzerland is already relatively green and low in carbon emissions. This is why using renewable energy decreases the total impact of producing a shoe by just 0.4%.

Figure 5: GWP Comparison: Conventional and LightSpray™ Technology Product Systems (Scenario 2)

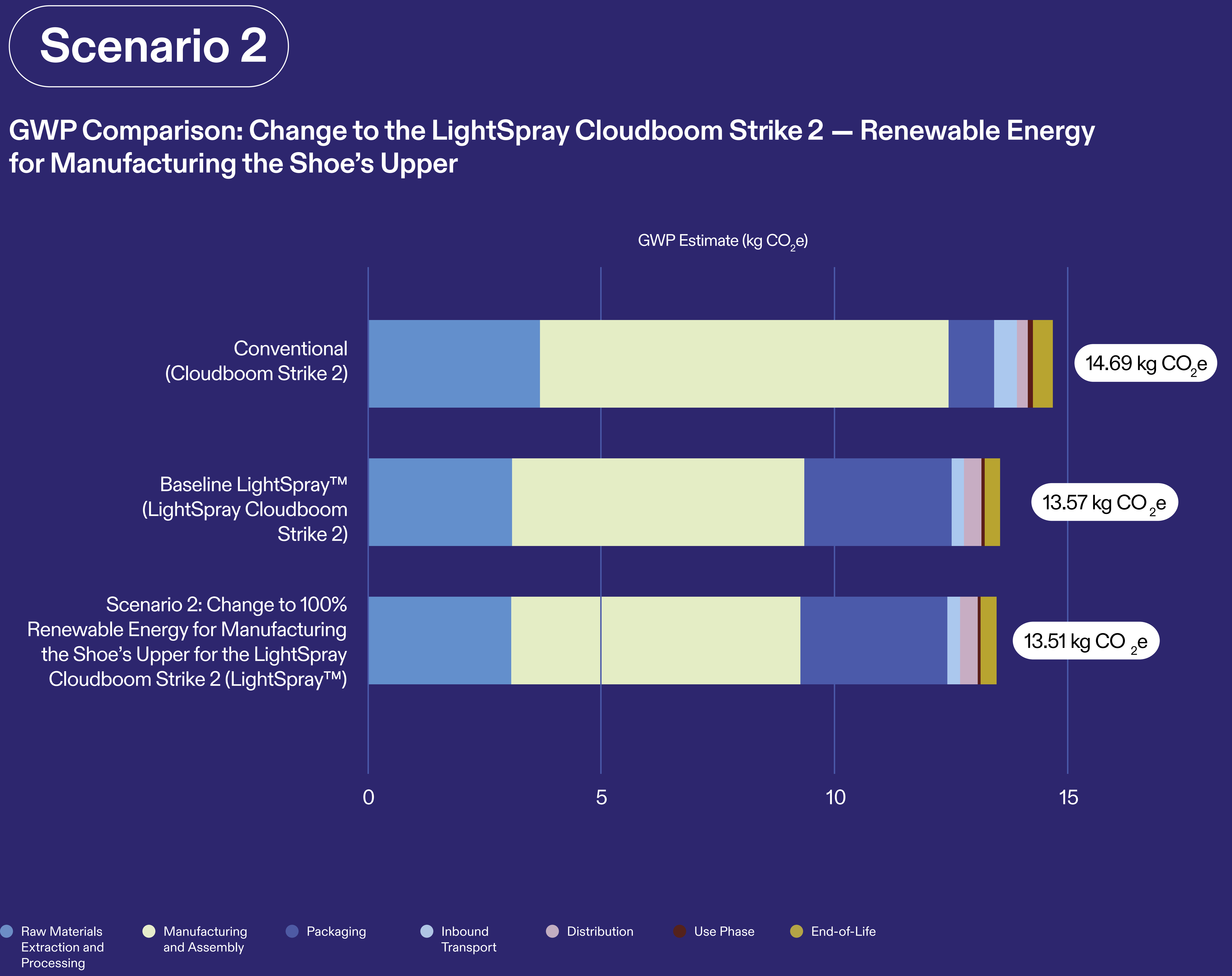
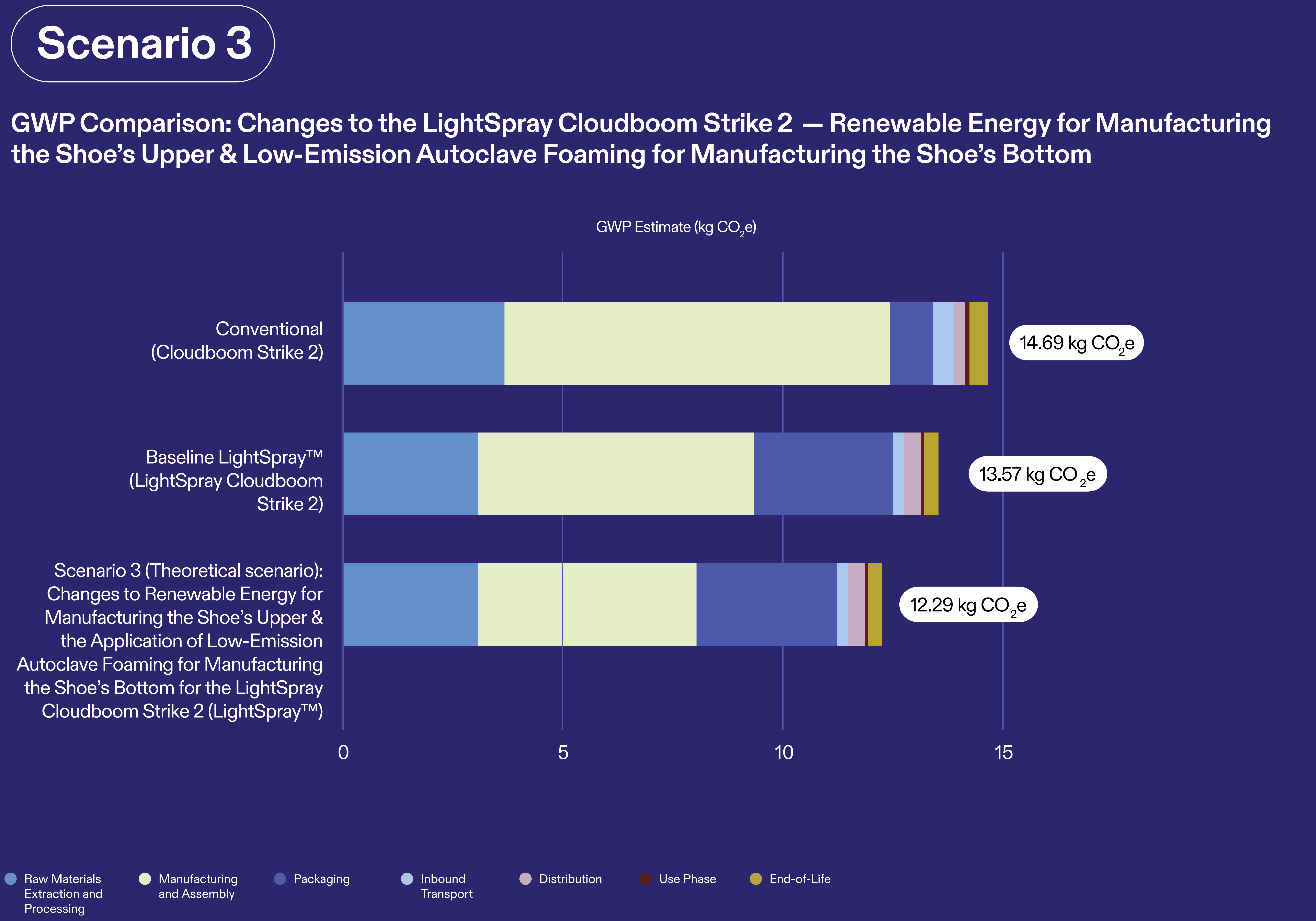


Figure 6: GWP Comparison: Conventional and LightSpray™ Technology Product Systems (Scenario 3)



Scenario 3 (Theoretical scenario): Changes to Renewable Energy for Manufacturing the Shoe's Upper & the Application of Low-Emission Autoclave Foaming for Manufacturing the Shoe's Bottom for the LightSpray Cloudboom Strike 2 (LightSpray™)

This scenario presents an optimised manufacturing process for the LightSpray™ technology. Not only is 100% renewable energy used in the innovative process, but the manufacturing of the bottom of the shoe is also environmentally improved. For this scenario, it was assumed that the emission factor for the autoclave foaming (material) process used to manufacture part of the bottom can be reduced by 22%. Results now show the component processing and assembly stage decreasing from 6.29 to 5.01 kg CO_2e, representing a 20% reduction. The overall footprint of the shoe drops by 9%. This scenario underscores the importance of optimising the manufacturing of all shoe components. While the LightSpray™ process shows substantial improvements in shoe upper manufacturing, there remains room for improvement in the bottom of the shoe. The total footprint of the LightSpray Cloudboom Strike 2 in this scenario is 16% lower than that of the Conventional shoe, demonstrating significant improvements and underscoring the importance of renewable energy use and energy efficiency in the manufacturing of all components.

Conclusion

Based on the results of this prospective attributional LCA analysis, several key conclusions can be drawn regarding the potential carbon footprint of LightSpray™ technology as it is scaled, compared with the Conventional athletic footwear production method employed by On.

Results indicated that, when comparing the **Cloudboom Strike 2** with the **LightSpray Cloudboom Strike 2**, LightSpray™ technology can materially reduce the climate change impact of an athletic shoe relative to the conventional upper manufacturing system within the defined system boundary (cradle-to-gate).

In the Baseline, LightSpray™ technology yielded a significant reduction in emissions per pair of athletic shoes, driven primarily by reductions in upper manufacturing emissions. A key contributor is the reduction in upper material production, process, and transport per pair, attributable to lower material mass and the use of a single material type rather than a Conventional multi-material construction (>10 material types), which also lowers inbound material transport demand. The technology also reduces product mass, which is expected to reduce weight-dependent impacts in downstream transport and, where modelled, in the use and end-of-life phases.

Scenario analysis showed that the magnitude and direction of potential benefits are sensitive to logistics and energy choices. Overall, the results in this report support LightSpray™ technology as a high-potential decarbonisation pathway for On's footwear manufacturing, and it can be further optimised by minimising air freight and improving energy and material performance across all components used to create On's athletic shoes.

In the future, the On team plans to explore the LightSpray™ reduction levers investigated in this report and more. Potential reduction pathways include improving raw material sources to lower the product carbon footprint of the raw materials used (for example, bio-based alternatives), improving overall production efficiency (for example, scaling up production capacity to lower the electricity required per pair produced), optimising logistics, and reducing environmental impacts stemming from the bottom unit.

These measures have the potential to further lower the impact of On's athletic shoe production via LightSpray™ as the technology scales.

Right now, On is testing how LightSpray™ technology performs as it moves from innovation into scale, using these findings to target the reduction levers with the most potential across materials, energy, and logistics to drive meaningful reductions in climate impact.

As it ramps towards wider commercial production, On will continue refining data and assessment to reflect real-world operating conditions, ensuring decisions remain science-based and effective.

Dream On.

Annex Korean Production Site Results

As a small volume of the LightSpray Cloudboom Strike 2 will be produced in Korea, the baseline scenario has been conducted for this production site. Results show that carbon emissions reduction is also achievable if the LightSpray™ technology is applied in Korea compared to the Conventional shoe production.

The following table shows the Baseline calculation modelled with a pair of Cloudboom Strike 2 production taking place in the Korean On's production site.

Korea LightSpray Life Cycle Stages	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	22.6%	-16.65%
(Upper Only)	0.53	3.9%	-44.18%
Component Processing and Assembly	6.75	49.7%	-23.39%
(Upper Only)	0.38	2.8%	-62.36%
Packaging	3.20	23.6%	234.24%
Inbound Transport	0.33	2.5%	-33.90%
Distribution	0.38	2.8%	61.56%
Use-Phase	0.06	0.5%	-20.21%
End of Life	0.34	2.5%	-19.58%
Total	**14.13**		**-3.81%**

The following tables show the same three scenarios calculated before, but for the production of the pair of shoes at the Korean On's production site.

Scenario 1

Scenario 1 LightSpray Life Cycle Stages 100% air freight, grid electricity, EF ACF 24.5 $kgCO_2e/kg$	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	17.51%	-16.65%
(Upper Only)	0.53	3.03%	-44.18%
Component Processing and Assembly	6.75	38.57%	-23.39%
(Upper Only)	0.38	2.15%	-62.36%
Packaging	3.20	18.27%	234.24%
Inbound Transport	4.38	25.06%	766.37%
Distribution	0.38	2.15%	61.56%
Use-Phase	0.06	0.36%	-20.21%
End of Life	0.34	1.97%	-19.58%
Total	**18.18**		**23.76%**

Scenario 2

Scenario 2 LightSpray Life Cycle Stages 7% air freight, renewable electricity, EF ACF 24.5 $kgCO_2e/kg$	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	25.73%	-16.65%
(Upper Only)	0.53	6.73%	-44.18%
Component Processing and Assembly	6.43	54.86%	-27.05%
(Upper Only)	0.05	0.69%	-94.55%
Packaging	3.20	8.39%	234.24%
Inbound Transport	0.33	3.76%	-33.90%
Distribution	0.38	2.48%	61.56%
Use-Phase	0.06	0.74%	-20.21%
End of Life	0.34	4.04%	-19.58%
Total	**13.81**		**-6.01%**

Scenario 3

Scenario 3 LightSpray Life Cycle Stages 7 % air freight, renewable electricity, EF ACF 19.0 $kgCO_2e/kg$	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	28.44%	-16.65%
(Upper Only)	0.53	7.44%	-44.18%
Component Processing and Assembly	5.20	50.10%	-40.94%
(Upper Only)	0.05	0.77%	-94.55%
Packaging	3.20	9.28%	234.24%
Inbound Transport	0.33	4.16%	-33.90%
Distribution	0.38	2.74%	61.56%
Use-Phase	0.06	0.82%	-20.21%
End of Life	0.34	4.47%	-19.58%
Total	**12.58**		**-14.34%**

Annex Zurich Production Site Results

The following table shows the Baseline calculation modelled with a pair of Cloudboom Strike 2 production taking place in the Swiss On's production site.

Base Scenario LightSpray Life Cycle Stages	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	22.6%	-16.65%
(Upper Only)	0.53	3.9%	-44.18%
Component Processing and Assembly	6.29	46.3%	-28.61%
(Upper Only)	0.07	0.5%	-93.13%
Packaging	3.20	23.6%	234.24%
Inbound Transport	0.24	1.8%	-53.05%
Distribution	0.38	2.8%	61.56%
Use-Phase	0.06	0.5%	-20.21%
End of Life	0.34	2.5%	-19.58%
Total	**13.57**		**-7.60%**

The following tables show the same three scenarios calculated before for the production of the pair of shoes at the Swiss On's production site.

Scenario 1

Scenario 1 LightSpray Life Cycle Stages 100% air freight, grid electricity, EF ACF 24.5 kgCO2e/kg	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	17.51%	-16.65%
(Upper Only)	0.53	3.03%	-44.18%
Component Processing and Assembly	6.29	35.94%	-28.61%
(Upper Only)	0.07	0.39%	-93.13%
Packaging	3.20	18.27%	234.24%
Inbound Transport	4.16	23.80%	722.77%
Distribution	0.38	2.15%	61.56%
Use-Phase	0.06	0.36%	-20.21%
End of Life	0.34	1.97%	-19.58%
Total	**17.50**		**19.13%**

Scenario 2

Scenario 2 LightSpray Life Cycle Stages 7% air freight, renewable electricity, EF ACF 24.5 kgCO2e/kg	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	25.73%	-16.65%
(Upper Only)	0.53	6.73%	-44.18%
Component Processing and Assembly	6.23	54.86%	-29.28%
(Upper Only)	0.01	0.69%	-99.05%
Packaging	3.20	8.39%	234.24%
Inbound Transport	0.24	3.76%	-53.05%
Distribution	0.38	2.48%	61.56%
Use-Phase	0.06	0.74%	-20.21%
End of Life	0.34	4.04%	-19.58%
Total	**13.51**		**-8.00%**

Scenario 3

Scenario 3 LightSpray Life Cycle Stages 7 % air freight, renewable electricity, EF ACF 19.0 kgCO2e/kg	$kgCO_2e$	% of total	Comparison to Conventional
Raw Materials	3.06	28.44%	-16.65%
(Upper Only)	0.53	7.44%	-44.18%
Component Processing and Assembly	5.01	50.10%	-43.17%
(Upper Only)	0.01	0.77%	-99.05%
Packaging	3.20	9.28%	234.24%
Inbound Transport	0.24	4.16%	-53.05%
Distribution	0.38	2.74%	61.56%
Use-Phase	0.06	0.82%	-20.21%
End of Life	0.34	4.47%	-19.58%
Total	**12.29**		**-16.34%**