GlaxoSmithKline PLC

Product Carbon Footprint Certification Summary Report

All of us at Carbon Trust Certification are delighted that you have been successful in your product carbon footprinting certification goals. You will shortly receive your certification letter and certificate of achievement. This report has been put together to provide you with a quick summary of the work we completed together. This report is intended to help you easily communicate the work you have done both internally and externally.

Summary

GlaxoSmithKline approached Carbon Trust Certification in early 2017. You contracted with us for a support in modelling your footprints and Certification of the product carbon footprints associated with your treatment of Chronic Obstructive Pulmonary Disease (COPD) and asthma. The certification of these product carbon footprints was successfully awarded to you on the 11th August 2017.

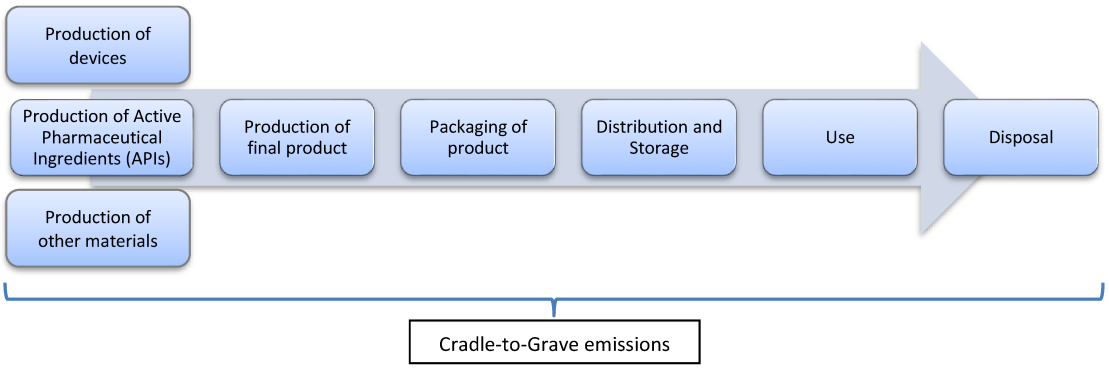
The footprinting work was carried out internally by your Sustainability Manager, Richard Henderson, with the support of the Carbon Trust Advisory Services.

Scope of Certification

We worked together to certify the cradle-to-grave (business-to-consumer) product carbon footprints of your Chronic Obstructive Pulmonary Disease (COPD) and asthma treatment products. This certification covered 12 individual product carbon footprints representing 12 individual Stock Keeping Units (SKUs). These product carbon footprints were certified against the requirements of the following internationally recognised standards:

- PAS 2050: 2011 – Specification for the assessment of the life cycle greenhouse gas emissions of goods and services;
- Greenhouse Gas Protocol – Product Life Cycle Accounting and Reporting Standard (2011);
- Product Carbon Footprint Protocol (parts 1 & 2); and,
- The certification requirements of the Footprint Expert™ Guide – version 4.2.

As pharmaceutical products, the Listed Carbon Footprint results were also checked against and confirmed to be consistent with the requirements set out in the 2012 Greenhouse Gas Protocol Pharmaceutical and Medical Device Sector Guidance for Product Life Cycle Accounting.



The cradle-to-grave product carbon footprints include all emissions from the full life cycle of your SKUs, from raw material production all the way to consumer use and disposal.

CARBON TRUST CERTIFICATION LIMITED
Dorset House
Stamford Street
London
SE19NT

T: +44 (0)20 7170 7000
F: +44 (0)20 7170 7020
certification@carbontrust.com

Footprint Results

In the table below you will find the carbon footprint results of your SKUs. For full details of all of your product carbon footprint results, please refer to your certification letter (CERT-12506).

Product Category: Asthma and COPD Treatment

Product	Stock Keeping Unit	Geographic Area	Net $kgCO_2e$ not rounded per pack	Net $kgCO_2e$ Rounded per pack	Net $kgCO_2e$ Rounded per actuation	Net $kgCO_2e$ Rounded per dose	Net $kgCO_2e$ Rounded per day
Ellipta	Relvar Ellipta 92/22 mcg	United Kingdom	0.776	0.80	0.026	0.026	0.026
	Anoro Ellipta 55/22 mcg		0.784	0.80	0.026	0.026	0.026
	Arnuity Ellipta 100 mcg*		0.771	0.75	0.026	0.026	0.026
	Incruse Ellipta 55 mcg		0.739	0.75	0.024	0.024	0.024
Diskus	Ventolin Accuhaler 200 mcg		0.583	0.60	0.010	0.010	As needed
	Seretide Accuhaler 50/500 mcg		0.898	0.90	0.015	0.015	0.030
	Flixotide Accuhaler 500 mcg		0.833	0.85	0.014	0.014	0.028
	Serevent Accuhaler		0.732	0.75	0.012	0.012	0.024
MDI	Ventolin Evohaler 100 mcg		28.262	28.00	0.141	0.283	As needed
	Seretide Evohaler 25/250 mcg		19.485	19.00	0.162	0.325	0.650
	Flixotide Evohaler 250 mcg		19.277	19.00	0.158	0.317	0.650
	Serevent Evohaler 25 mcg		19.223	19.00	0.158	0.317	0.650

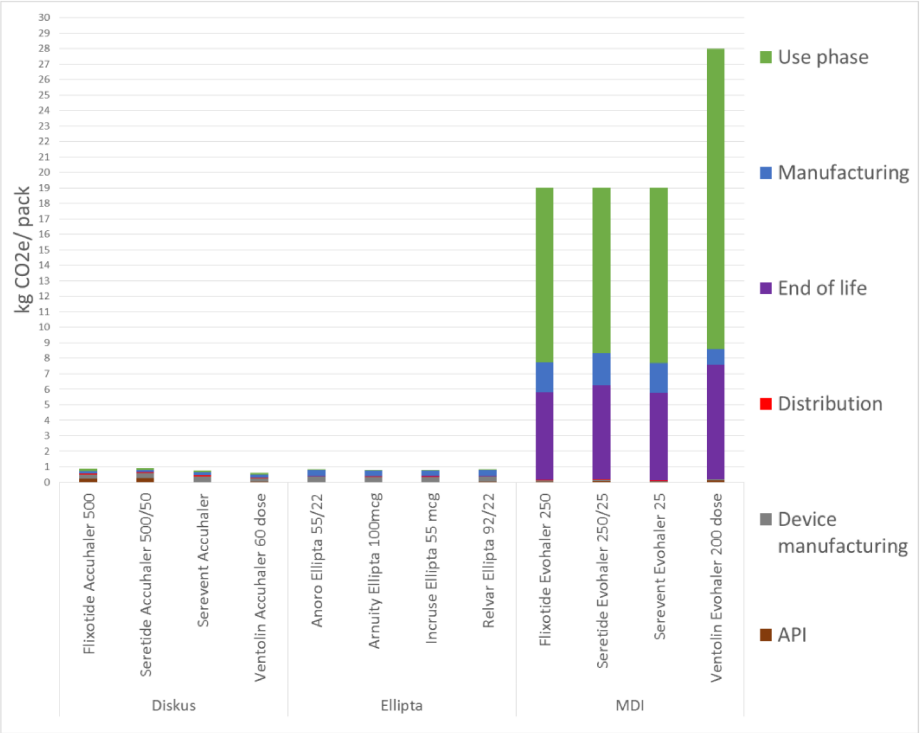
* Arnuity Ellipta 100 mcg is currently not sold in the UK. The footprint is based on using the same assumptions for UK distribution and end of life as the other two Ellipta products.

Breakdown of emissions

Total Carbon Footprints

Due to the different ways in which the three treatments are produced and used, the carbon footprints and the breakdown of those footprints vary drastically between the 3 product 'groups' (Ellipta, MDI and Diskus). In particular, products in the MDI product group have a much higher carbon footprint per device compared to the Ellipta and Diskus product groups. This is shown in Figure 1 below.

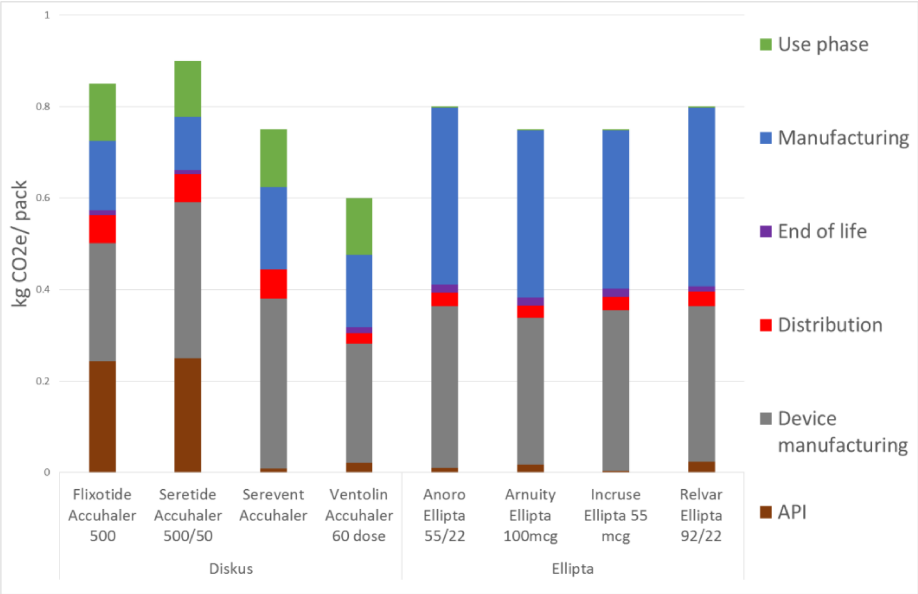
Figure 1: Absolute emissions per pack (kg CO2e/pack) for all products



To understand the results of Diskus and Ellipta in more detail, the same analysis is shown in Figure 2 but with products in the MDI product group removed.

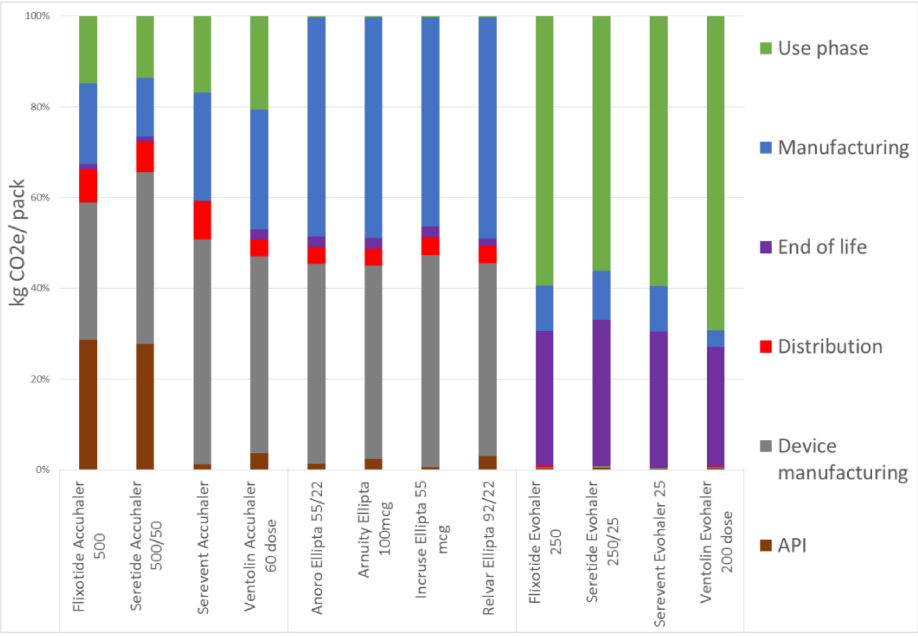
Janson C, *et al. Thorax* 2019; 0:1–3. doi: 10.1136/thoraxjnl-2019-213744

Figure 2: Absolute emissions per pack (kg CO2e/pack) for all products



The percentage breakdown of the footprints by lifecycle phase is shown in Figure 3 below.

Figure 3: Breakdown of emissions per pack for all products



The following sections provide a more detailed analysis of the sources of emissions within the largest contributors to each footprint.

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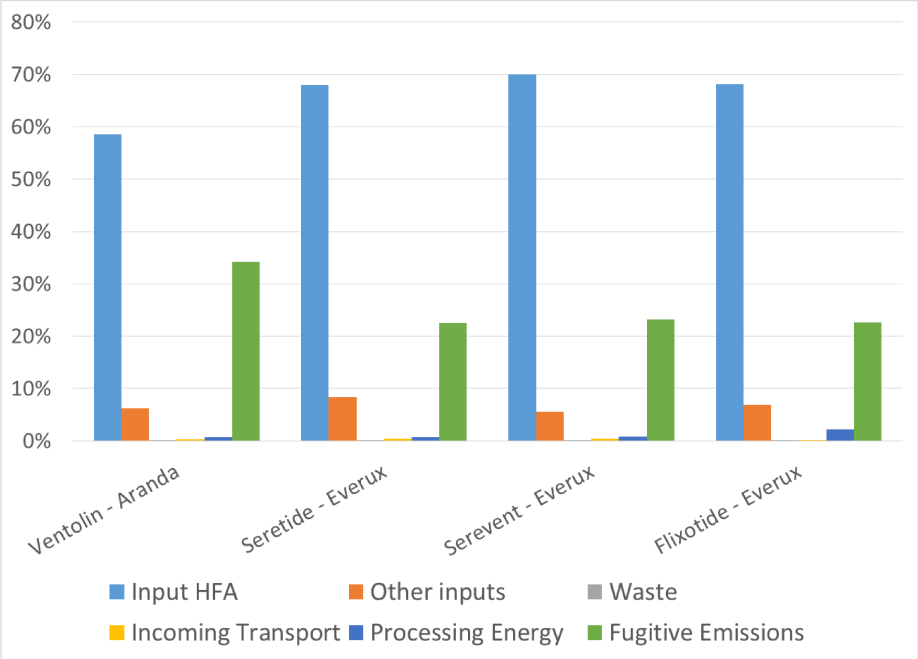
Large Contributors – MDI products

Within the MDI product group, over 99% of the footprint of footprint can be attributed to three lifecycle phases – use phase, end of life and manufacturing. The emissions of use phase and end of life are almost entirely made up of the HFA-134a propellent, of which two thirds are assumed to be discharged during use and one third discharged during end of life as waste. These assumptions are unchanged from the previous certification.

With regards to manufacturing, emissions are driven by input HFA as well as waste HFA from the process, as seen in the following chart.

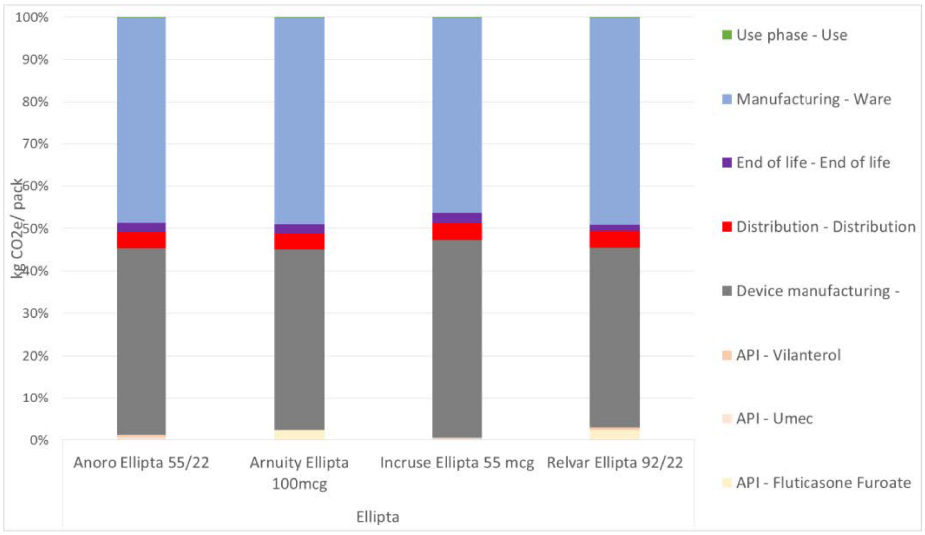
Figure 4: Largest contributors to Manufacturing phase of MDI products



Large Contributors – Ellipta products

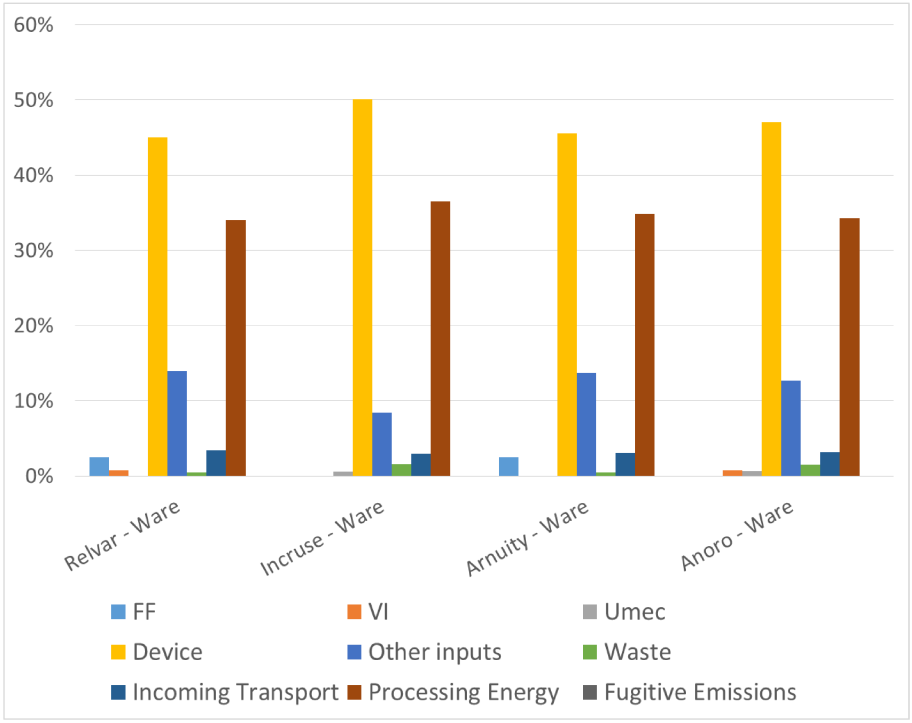
The footprints of the Ellipta products are driven by two main processes, the manufacturing process at Ware and the device manufacturing process by our supplier in Germany, as seen in the figure below. Together, the two processes make up 90% of the footprints of Ellipta products.

Figure 5: Largest GHG contributors to Ellipta products



The footprint of the supplier device component manufacturing process is unchanged from the previous certification due to the unavailability of updated primary data from the supplier. With regards to manufacture at Ware, the major contributors to the footprint of the process can be shown in the Figure below.

Figure 6: Largest contributors to Manufacturing phase of Ellipta products



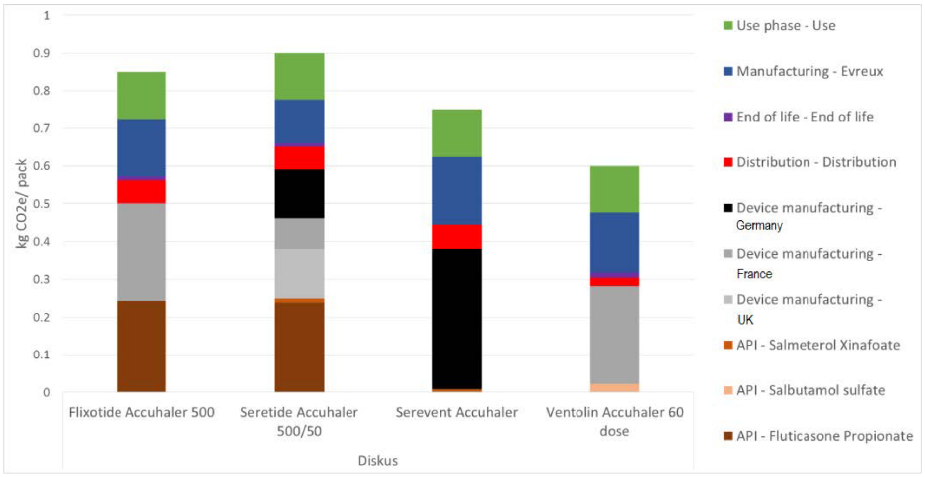
Between 45-50% of the footprint of the Ware process is made up of the embedded emissions of the Ellipta devices. Energy make up between 34-36% of emissions in this process, of which approximately 20-22% comes from natural gas and 12-14% comes from electricity.

Large Contributors – Diskus products

The footprint contributors to Diskus products are more varied than for MDI and Ellipta products. As can be seen in Figure below, there are two main drivers for the footprints of Diskus products – the strength of API applied in the product and supplier(s) relied on for the devices. The API Fluticasone Propionate is applied in stronger doses and makes up 26% and 29% of the footprints of Seretide Accuhaler and Flixotide Accuhaler respectively, while the APIs Salbutamol Sulfate and Salmeterol Xinafoate, which are applied in smaller doses, only make up 4% and 1% of the footprints of Ventolin Accuhaler and Serevent Accuhaler respectively.

With regards to supplier(s) of Diskus devices, components and parts come from the supplier in France, the supplier in Germany and the supplier in the United Kingdom. The footprints of these suppliers were originally calculated using primary data from suppliers in 2013 and are unchanged in the 2016 footprint due to unavailability of updated primary data. Diskus products that have devices/components sourced from the supplier in France have lower device footprints due to the lower grid emission factor of the French electricity grid, which is made up almost entirely from nuclear generated power. Ventolin Accuhaler has the lowest footprint of the Diskus products due to the lower strength of API applied (no Fluticasone Propionate) and the fact that all devices are sourced from the supplier in France.

Figure 7: Largest GHG contributors to Diskus products



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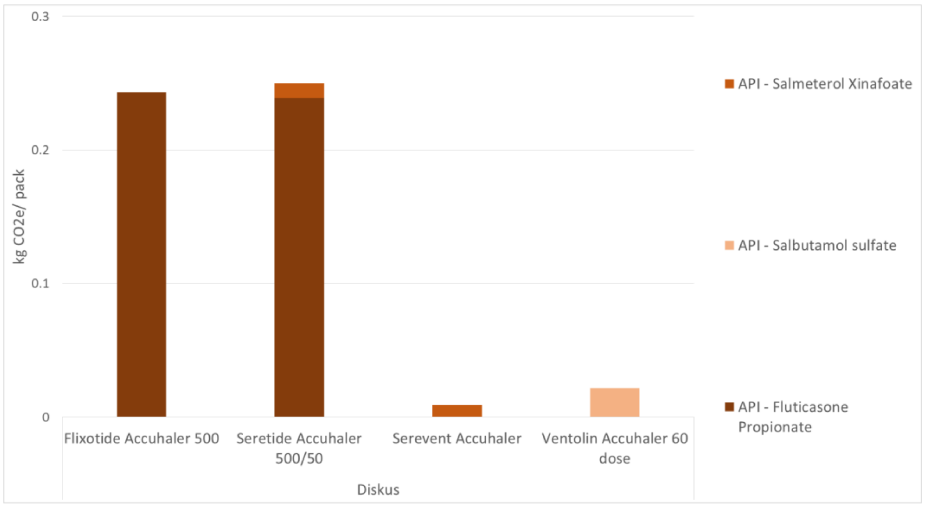
Looking at the contribution of APIs in more detail, it can be seen that products that use Fluticasone Propionate have higher footprints than products that do not. This is due to the higher embedded footprint of Fluticasone Propionate (which contains hydroxyl acid, a highly carbon intensive API input) compared to other APIs and the higher product strength of products based on this API.

Figure 8: GHG contribution of APIs in Diskus products



Data Collection

As with the previous certification round, Richard and his team collected all the required primary data for all sites owned and operated by GSK to calculate the footprints

- The data from the production of the APIs was primary data taken directly from the Jurong Factory for the 2016 year. Energy at these sites was allocated based on firstly the area(s) of the site that produced APIs for respiratory products, and secondly the physical volumes of the different types of APIs produced.

- The data for the production of the final products was primary data taken directly from the Ware, Evreux and Aranda production sites for the 2016 year. Energy at these sites was allocated based on firstly the area(s) of the site that produced respiratory products, and secondly the physical volumes of the differences types of respiratory products produced.

Unlike the previous certification round, primary data was not collected from GSK's device manufacturers in the UK, France and Germany. This was accepted on the basis that although primary data from suppliers were not available this time, the devices are highly regulated and the specification of the devices have not changed since 2013. Thus, previous results are still considered as accurate. Primary data from GSK still account for at least 10% of the footprint of all products, meeting the requirements of PAS2050:2011. To summarise, the footprint results from the following processes were taken directly from previous certified GSK footprints:

- The manufacturing of Ellipta devices in Germany.
- The manufacturing of actuators for MDI devices in Spain.
- The manufacturing of MDI cans for MDI devices in Germany.
- The manufacturing of Diskus devices/components in Germany.
- The manufacturing of Diskus devices/components in France.
- The manufacturing of Diskus devices/components in UK.

As with the previous certification, the following data was collected for the distribution, use and end of life stages:

- The retail stage (i.e. pharmacy storage) was considered to be immaterial to these footprints since all 12 products are stored at ambient temperature. Therefore retail emissions were not calculated.

- The distribution and end of life stages were calculated using the Footprint Expert calculators which were populated with good quality secondary data on transport distances (i.e. google maps) and product weights.

- The use phase was calculated using the known propellant release of each actuation (for MDI products) and the instructions for use of the products in their patient pamphlets.

Preferential application of primary emissions factors were used where available. Where no primary emissions factor was available, conversion factors (emissions factors) were taken from the Footprint Expert database (version 4.3) which were provided to you with your Footprint Expert Toolkit licence. Where no relevant emissions factor was available in the Footprint Expert™ database, emissions factors were taken from the GlaxoSmithKline emissions factor database or a proxy emissions factor was applied.

Communications

You have achieved full certification against all the required standards for use the Carbon Trust's 'Carbon Measured' label. As a valued customer we have provided a free licence for use of the label. Please get in touch to discuss how you could use this label and promote the work you have done on product carbon footprinting. We would be more than happy to work with you on options for joint marketing and PR in association with this certification.

Recommended Future Actions

Due to the importance of device manufacturing to Ellipta and Diskus products, we recommend that GSK re-engages with the device component suppliers to collect accurate, recent primary data so that any recent improvements and changes at supplier level are taken into account, and so that GSK has the correct data to monitor your product carbon footprint over time.

For consistency in future footprinting and maintain high levels of data quality, GSK should look to develop a data collection and data quality manual covering all sites that GSK owns and operates (for internal use). This would document the exact processes of obtaining primary data at Jurong, Montrose, Evreux and Ware, specify the exact reports to be generated and the allocation methodologies and calculations to be applied to split energy at the API or SKU level. This manual would be used to guide any future verification services, including a potential site visit to review its use and the knowledge of staff using it. This will be beneficial in addressing any questions around the processes used and where data is gathered for the next audit.

In general, incremental improvements can be made to the way energy data is allocated between APIs and between the final products. It was noted in this certification that at times, the initial percentage allocation of energy between respiratory and non-respiratory products was evidenced by an email from the site manager, instead of calculated outputs from raw data. Going forward, clear documentation should be kept for all the percentages calculated.

Within respiratory products/APIs, the allocation of energy by API or final product was conducted by product volume. Going forward, GSK should look to collect more primary data on differences in energy requirements between different outputs, especially for APIs. A more granular analysis can be made to look at, for example, whether certain APIs require more electricity, steam, or natural gas than other APIs. It is appreciated by the Carbon Trust this is a long-term improvement however this should be prioritised for future footprinting.