

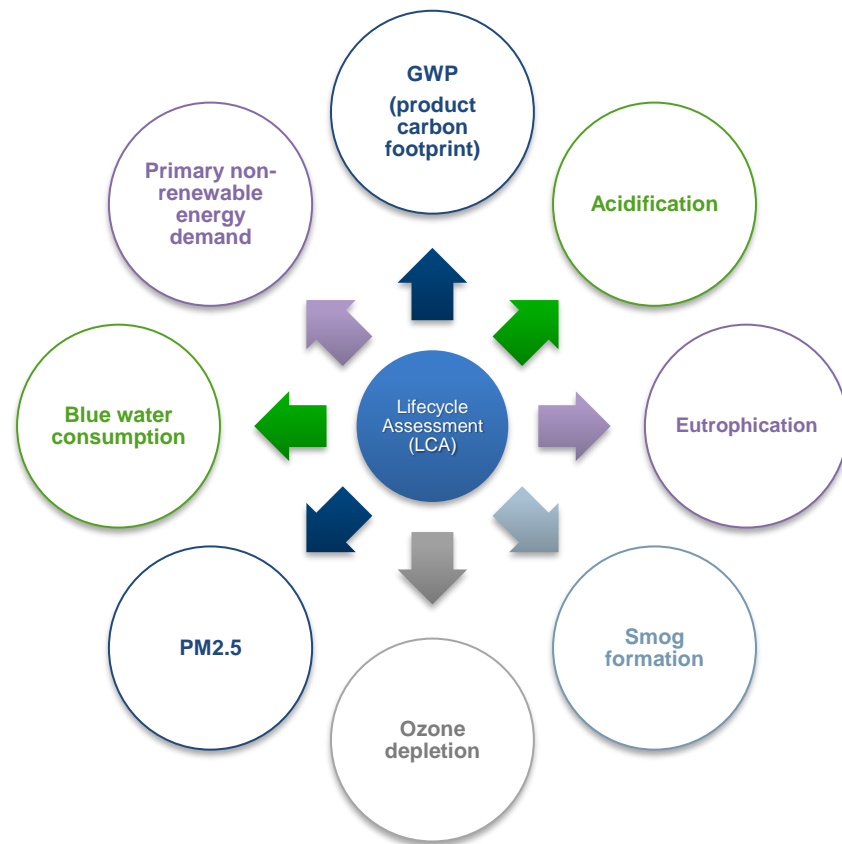
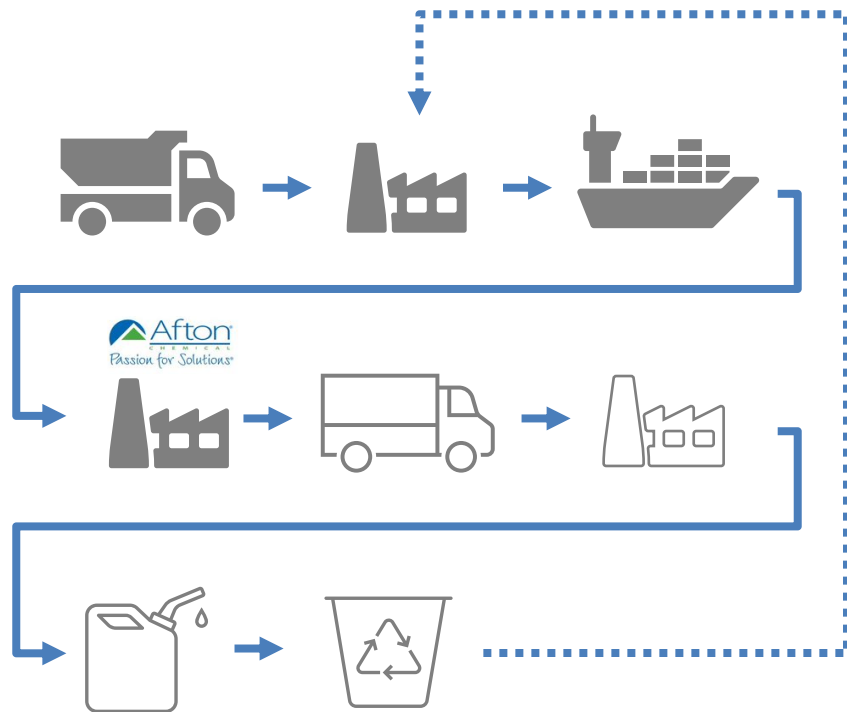
Reducing Product Carbon Footprint of Lubricants and Greases

Benn Heatley
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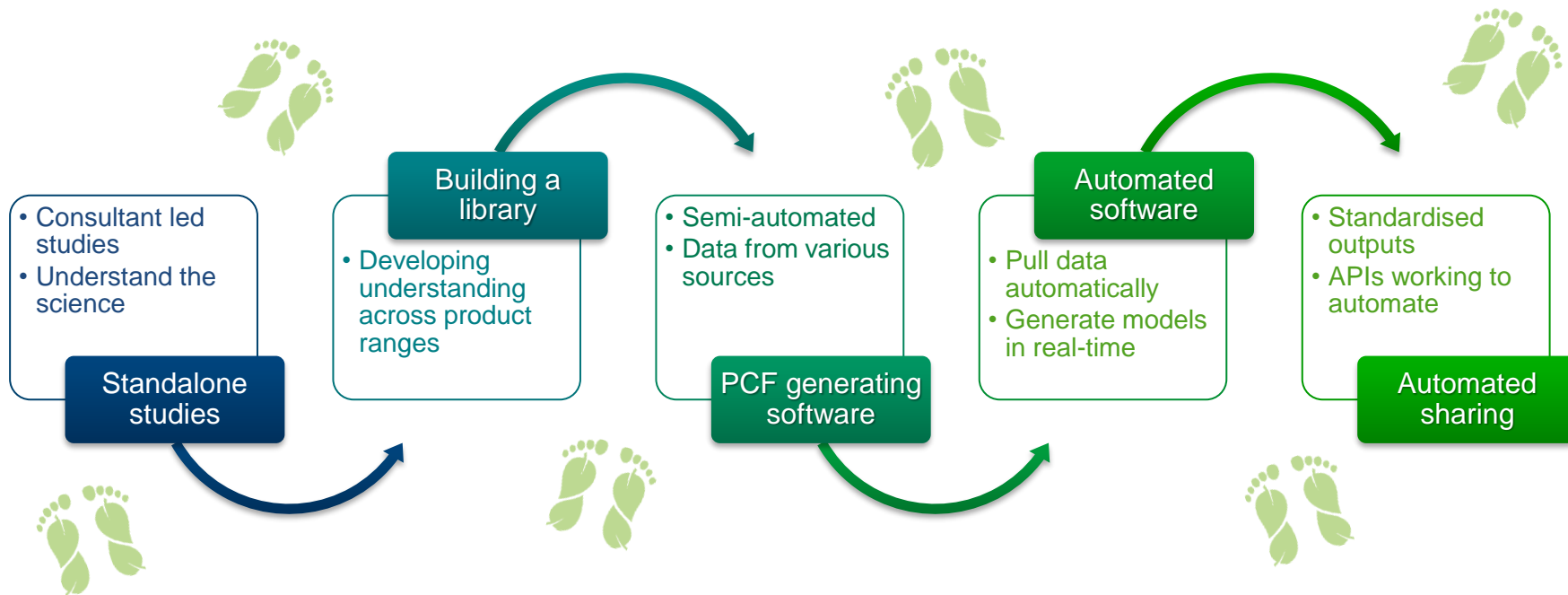


What is Product Carbon Footprint (PCF)?

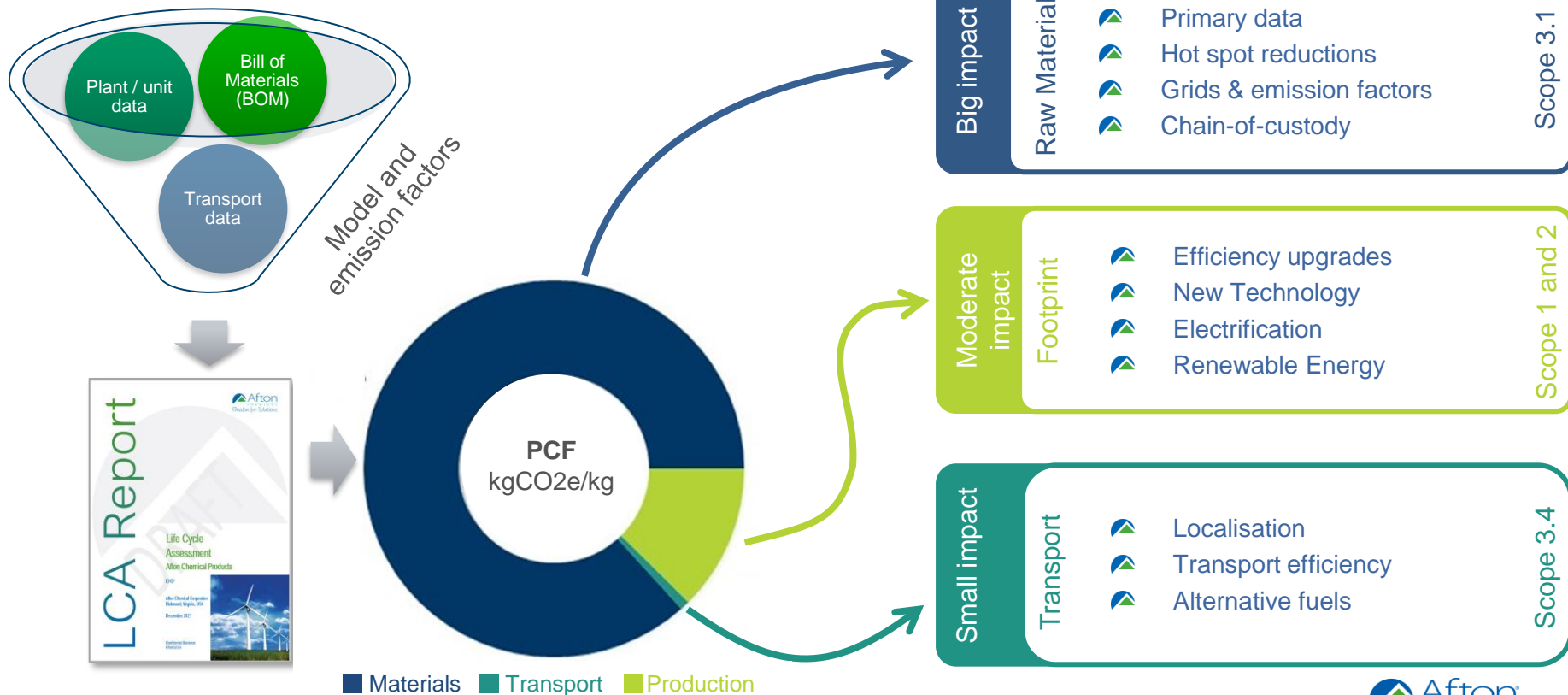
Lubricant additive manufacturers perspective



The evolution of Product Carbon Footprint

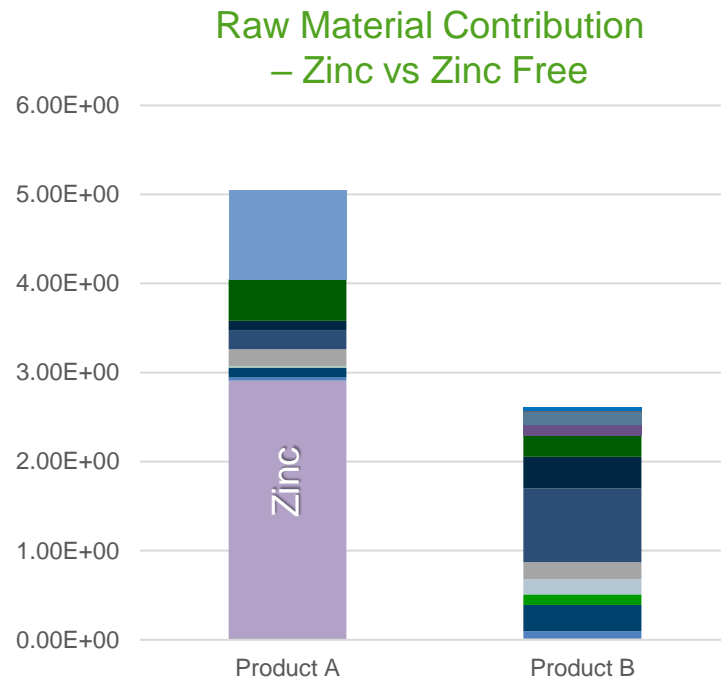


Step 1: Understand where you are



Step 2: Identify and address hotspots – example

- PCF data analysis allowed us to identify a hot spot in PCF for additives containing zinc
 - Mining, refining, and purification lead to a relatively high PCF
- This allows R&D teams to focus on alternative formulations that address these hotspots
- Results: 33% lower PCF for the Zinc-free option with no compromise on performance



Step 3: What are the big levers in the future?

Data sharing and automation

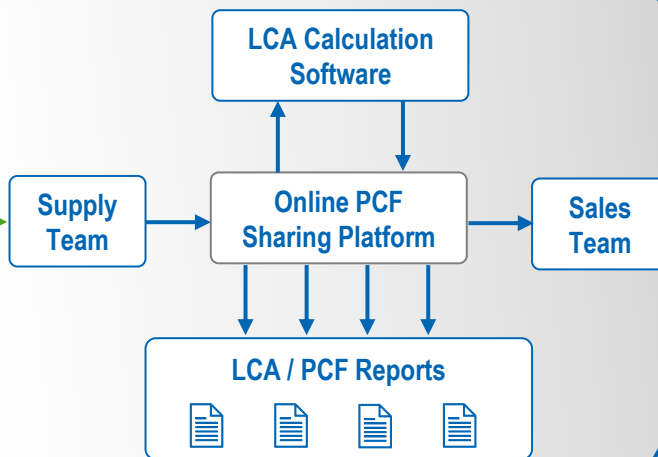
UPSTREAM

Supplier A

Supplier B

Supplier C

COMPANY BOUNDARY



DOWNSTREAM

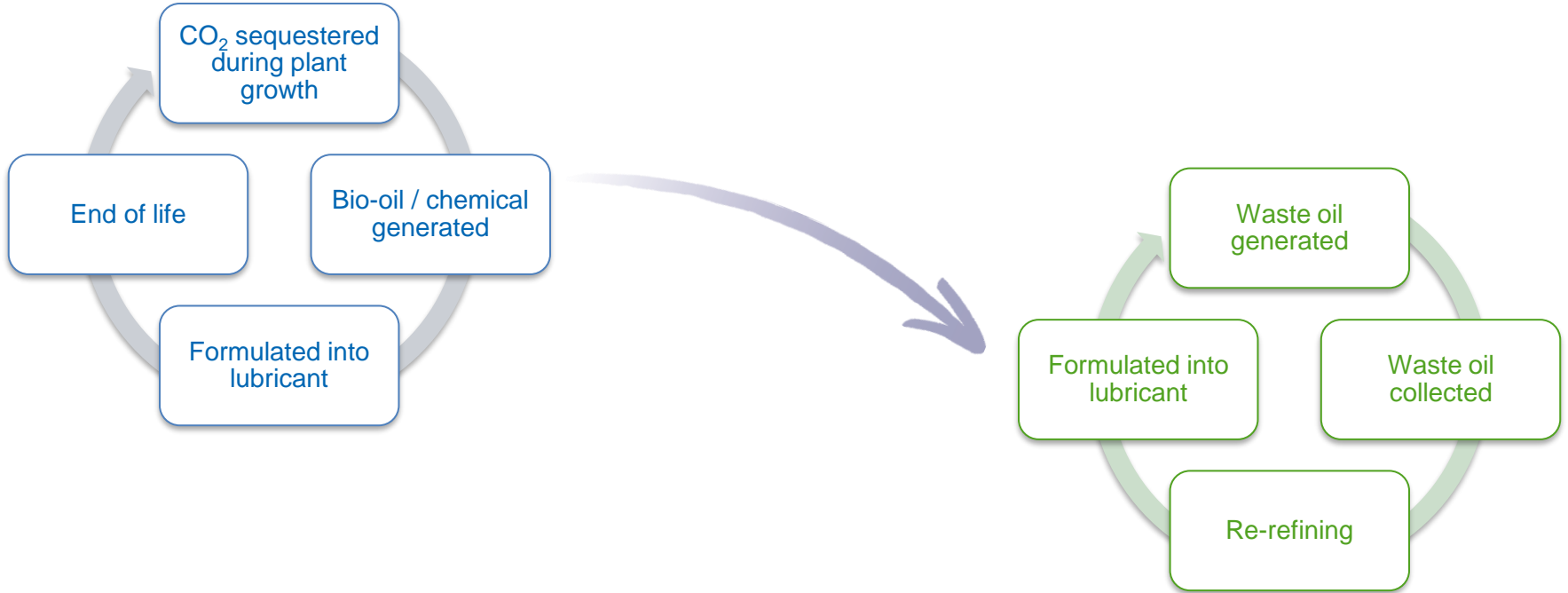
Customer A

Customer B

Customer C

Step 3: What are the big levers in the future?

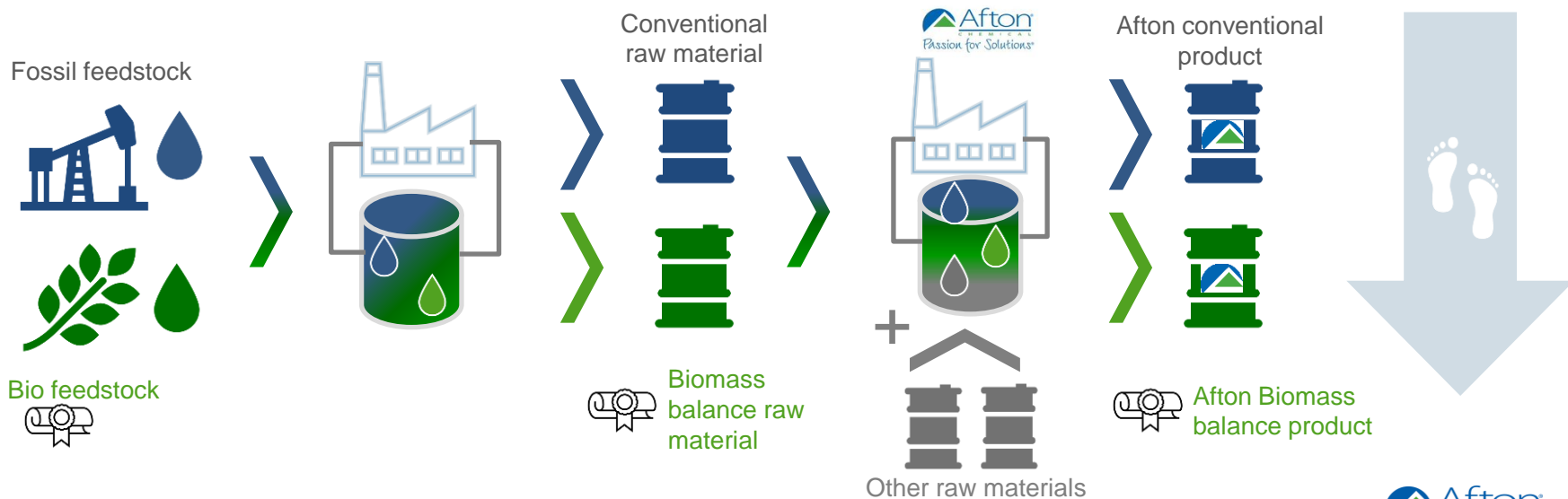
Re-refined base oil and bio-based – made with or made for



Step 3: What are the big levers in the future?

Chain-of-custody: mass balance

- ▶ Different feedstocks with the same product
- ▶ $\Sigma \text{ input} \geq \Sigma \text{ output}$
- ▶ Certified chain of custody



Thank you

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