TECHNICAL MANUAL · 2026 EDITION

PACKAGING CARBON FOOTPRINT IN CANADA

A calculation and reduction manual for Canadian manufacturing

INCLUDES EXCEL CALCULATOR

11 sheets · live formulas · all 13 provinces and territories

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Contents

The master list of factors

Nine blocks. A packaging carbon footprint that is missing one of them is not finished. They do not weigh the same — in a typical package, materials and energy explain more than eighty per cent — but a gap in any of them is a question you will be asked.

1 · Boundary and unit

- Declared functional unit, with its four parts
- System boundary: cradle-to-gate or cradle-to-grave
- Calculation period
- Allocation method — **cut-off** unless stated otherwise
- Base year, recalculated on current factors
- GWP set used (AR5 here, and say so)

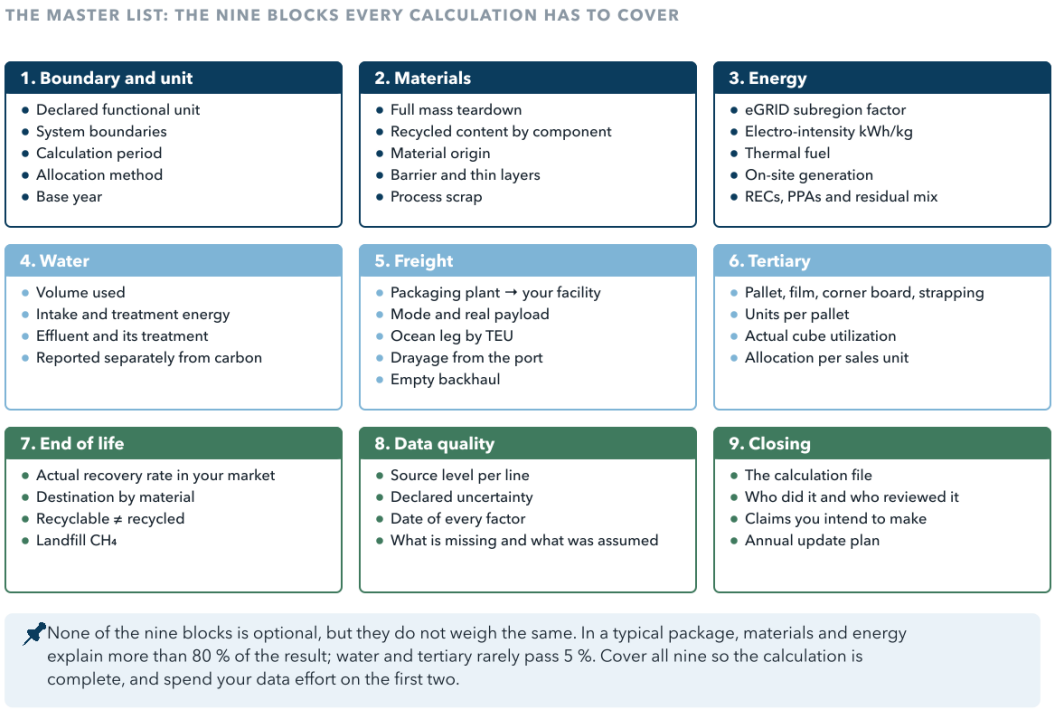

Figure 1. *The nine blocks every packaging footprint calculation has to cover.*

2 · Materials

- Full mass teardown, component by component, weighed
- Recycled content per component, pre- or post-consumer, physical or mass balance
- Material origin — including **where the metal was smelted**, not just where it was formed
- Barrier and thin layers, by name and basis weight
- Process scrap rate, and whether the supplier’s factor includes it

Introduction: two orders of magnitude

Here is the number this book is built around.

An aluminum can, made in Quebec, carries the electricity of a grid that emits **1.9 grams of CO_2e per kilowatt-hour**. The same can, same alloy, same machine, same wall thickness, made in Saskatchewan, carries a grid that emits **631**.

That is a factor of **332**. Not thirty-two per cent. Three hundred and thirty-two times.

Both numbers come from the same table, published by Environment and Climate Change Canada, for the same year, for the calculation of the same kind of thing. Neither is an outlier or a special case: Quebec and Saskatchewan are both ordinary places to manufacture packaging, and both do.

> 📌 **Key figure**
>
> Provincial electricity consumption intensities for 2026 run from **1.9 g CO_2e/kWh in Quebec** to **631 in Saskatchewan** — 332 times — and to **800 in Nunavut**, which makes it 421 across all thirteen jurisdictions.
>
> *Source: ECCC, Emission Factors and Reference Values, version 3.0, October 2025, Table 5.3. Full table in Annex C and on the F_GRID sheet of the calculator.*

What that does to the arithmetic

The rest of this book is technique, and the technique matters. But the first thing to understand is that in Canada, a great deal of what passes for packaging sustainability work is rounding error against the map.

A lightweighting project that takes eight per cent out of a bottle is real work. It takes months, it costs money, it risks the line. Moving that same bottle's production from a coal-heavy grid to a hydro grid changes the electricity portion of its footprint by more than a hundredfold. Nobody is suggesting you relocate a plant to improve a number — but you should at least know which of those two things you are looking at when you compare two suppliers' quotes.

And you should know that your competitor may already have the better number without having done anything at all, simply by being located where they are.

What this book will not do

It will not tell you that packaging is the problem, or that it is not. It will not rank materials into good and bad — you will find, repeatedly, that the ranking flips when the functional unit changes, and that a material which loses on manufacturing wins at end of life, or the reverse.

It will not give you a number you can put on a package without doing the work behind it. Since June 2024 and, in its amended form, since March 2026, Canadian law has an opinion about unsubstantiated environmental claims, and that opinion is in the Competition Act. Chapter 31 covers what changed and what did not.

PART I · WHAT YOU ARE MEASURING

1. Why they are asking you for this number

Somebody has asked you for the carbon footprint of your packaging, and you have opened this book because the request did not come with instructions. It rarely does.

The short answer to *why* is that four different pressures arrived in Canada within about two years of each other, and they all resolve into the same request landing on the same desk. It is worth knowing which one is behind yours, because they ask for different things and they accept different answers.

Pressure one: the Federal Plastics Registry

If your company manufactures, imports, or places plastic packaging on the Canadian market, and you put more than **1,000 kilograms** of it on the market in a calendar year, you are a reporting producer.

What the registry wants is not a carbon number. It wants an inventory: **resin type, resin source, category and subcategory of product, the quantity of each resin in kilograms** — and, note this, **the calculation method you used to arrive at those quantities.**

The reporting rhythm as it stands: **Phase 1 obligations remain in place for calendar years 2026 and 2027**, with Phases 2 and 3 deferred. Each year's data is due by **September 29 of the following year**, so 2026 data is due September 29, 2027.

Read that requirement again, because it is the theme of this entire book arriving in federal regulation: you have to declare *how you calculated*. Not just the answer. The method.

> ⚠ **Accounting trap**
>
> Companies discover the registry, build a resin inventory to satisfy it, and file it in a compliance folder. Then six months later the sustainability team builds a packaging footprint from scratch, using different masses, because nobody told them the inventory existed. Two numbers for the same packaging, produced by the same company, that do not reconcile. When a customer or a regulator eventually places them side by side, the problem is not which one is right.
>
> The teardown in Chapter 5 is the same teardown the registry needs. Do it once.

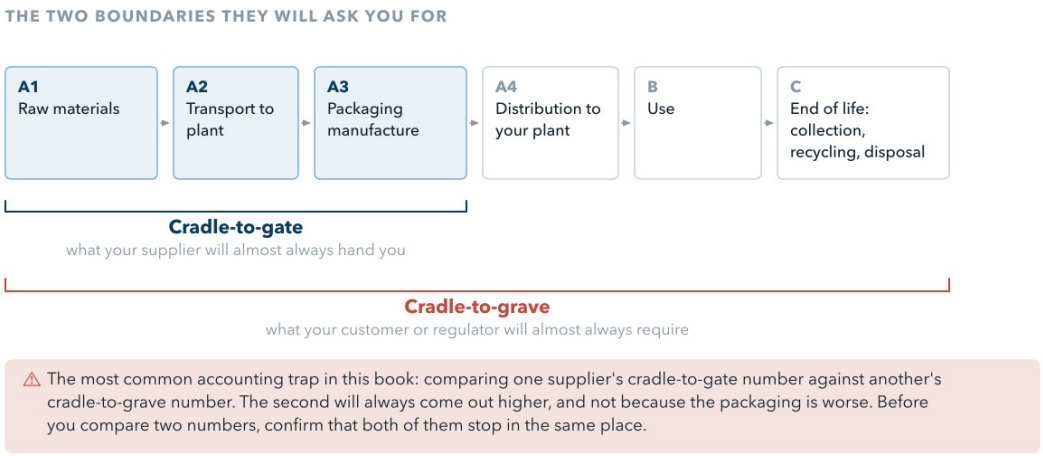

Figure 3. *The two boundaries you will be asked for, and why they cannot be compared.*

What CO_2e is doing

Packaging emissions are not only carbon dioxide. Methane comes out of landfilled fibre. Nitrous oxide comes out of adipic acid production for nylon 6.6. Perfluorocarbons come out of anode effects in aluminum smelting. These gases warm the atmosphere at very different rates, so they are converted into a common currency using **global warming potentials** over a hundred-year horizon.

Which set of potentials you use matters more than it sounds, and it is a live inconsistency: Environment and Climate Change Canada's current factors are built on the IPCC's Fifth Assessment Report values, while ISO 14067 points at the most recent assessment. The difference on methane alone is around a fifth. The rule this book follows, and the one you should follow, is not to pick the favourable one. It is to **state which you used**, once, in the report.

What it is not

It is not a certification. A footprint calculated with this book is a documented calculation. That is a different object from a third-party verified declaration, and the difference is a paid auditor. Chapter 27 and the calculation-file annex explain when you actually need the auditor — which is less often than the market implies.

It is not a comparison, until you make it one. A single number in isolation tells you nothing about whether a package is good. It tells you what it is. Comparison requires a shared functional unit, a shared boundary, a shared allocation method and a shared data vintage. Four conditions. Most published comparisons meet two.

It is not stable. The same package, calculated correctly in 2023 and again in 2026, will give different answers in Canada without anyone changing anything, because the provincial grid factors moved. Alberta went from 540 to 438 g CO_2e/kWh across those years; Ontario went from 30 to 59 in the other direction. A footprint is a photograph of a period, and the period belongs in the report.

PART II · THE PROVINCE FACTOR

6. Your province decides more than your design

This is the chapter the Canadian edition exists for.

In most countries, the electricity behind a package is a modest correction — worth getting right, rarely decisive. In Canada it is frequently the largest single variable in the calculation, and it is one you do not control through design at all. You control it through a decision that was probably made for other reasons, years ago, by someone in operations: **where the plant is.**

The table

Province / Territory	g CO_2e per kWh consumed, 2026
Quebec	**1.9**
Manitoba	2.5
Newfoundland and Labrador	17
British Columbia	18
Ontario	59
Yukon	74
New Brunswick	234
Prince Edward Island	234
Northwest Territories	420
Alberta	438
Nova Scotia	581
Saskatchewan	631
Nunavut	800

Source: Environment and Climate Change Canada, Emission Factors and Reference Values, version 3.0, October 2025, Table 5.3, values for calendar year 2026. Reproduced in full with notes in Annex C and on the F_GRID sheet of the calculator.

Two things the source itself says, which you should repeat when you cite it:

- **Prince Edward Island carries New Brunswick's value**, because it imports most of what it uses.
- These are **consumption** intensities. They already account for transmission losses and imported power, which is why they are the right ones for a footprint and why they must never be mixed with *generation* intensities from another source.

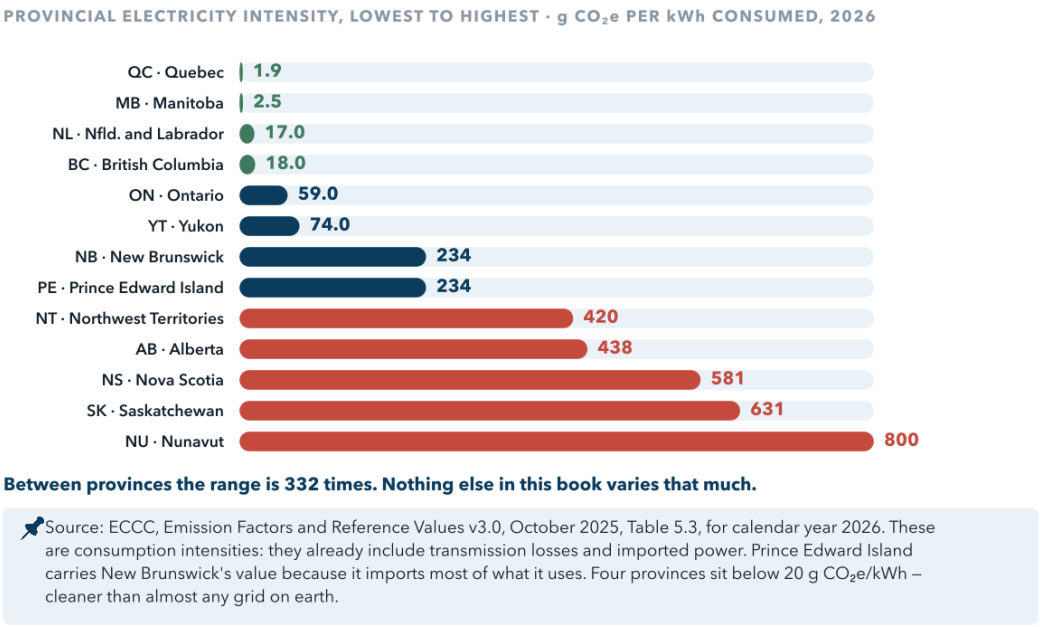

Figure 7. *The 13 provincial and territorial electricity factors, ranked.*

What to do with it

Published material emission factors carry the electricity of wherever they were measured — usually Europe, occasionally a global average. To use one in Canada you strip that electricity out and put your own province's back in:

```
corrected EF = (published EF − kWh/kg × 0.45) + kWh/kg × your
provincial factor
```

The 0.45 kg CO_2e/kWh is the world-average grid this book uses to separate the electric share out of published factors. The `kWh/kg` is the material's **electro-intensity** — how many kilowatt-hours it takes to make a kilogram. Annex B carries it for every material in the book.

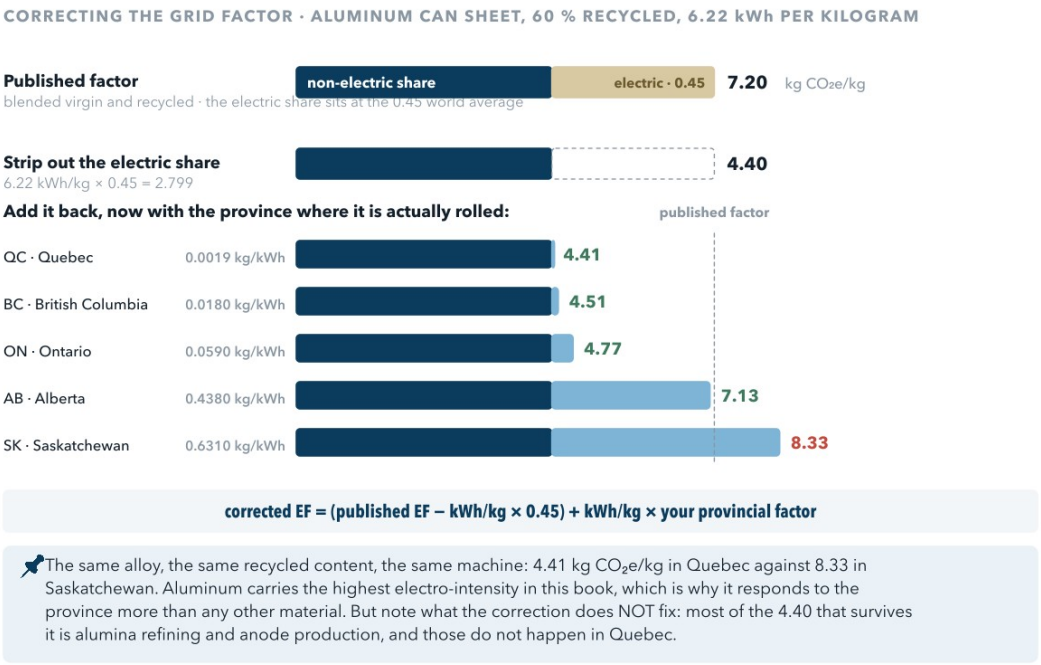

Figure 8. *Correcting the grid factor, step by step, on aluminum can sheet.*

The worked example, and why it was chosen

Aluminum can sheet at 60 % recycled content. Blending virgin and recycled gives a factor of 7.20 kg CO_2e/kg and an electro-intensity of 6.22 kWh/kg. Strip the electricity out and 4.40 remains. Now add each province back:

Province of the rolling mill	kg CO_2e per kg of can sheet
Quebec	**4.41**
Ontario	4.77
Alberta	7.13
Saskatchewan	**8.33**

Same alloy. Same recycled content. Same machine. **Eighty-nine per cent apart.**

And if you take the same arithmetic to **primary** aluminum, where electro-intensity is 14.5 kWh/kg, the spread runs from roughly **10.0 kg CO_2e/kg in Quebec to 19.1 in Saskatchewan** — against a global default of 16.5. That first number is the Canadian aluminum advantage, quantified, and Chapter 13 is about how to document it so a customer will accept it.

> ⚠ **Accounting trap**
>
> Correcting the grid fixes the **electricity** share and nothing else. In that primary aluminum figure, the 9.975 that survives the correction is mostly alumina refining and anode production — and those do not happen in Quebec. A Quebec smelter running on hydro power still buys alumina refined elsewhere, usually with fossil heat.

same price, one in Quebec and one in Saskatchewan, are not selling the same product in carbon terms, and the difference is larger than anything either of them could achieve by redesigning it.

🔎 **Ask your supplier**

“Which plant and which province manufactures this component? For that plant, please give us the electricity consumed per unit or per tonne of product, the provincial grid factor you applied and its source and year, and whether the plant holds any renewable energy contracts. If you supply us from more than one plant, we need the split.”

What to do today

1. Fill in the province column of your teardown. Every component, every plant.
2. Multiply each material’s electro-intensity by the provincial gap and sort the list. That tells you which two or three components deserve real data and which ones you can leave at a reference value.
3. Check the year of every grid factor already in use in your company. If any of them predates 2025, it is wrong now, and in Ontario it is wrong by a factor of two.