Estimating CO2

How to calculate it (step-by-step)

1. Decide or measure the **paper weight per copy** (grams).
    - For A5, 12 pages = 6 sheets (both-sides). Area of one A5 sheet = 0.148 m × 0.210 m = 0.03108 m^2.
    - Paper mass per copy (kg) = area per copy (m^2) × paper GSM (g/m^2) ÷ 1000.
2. Multiply the mass per copy by a **paper production emission factor** (kg CO_2e per kg paper). That gives paper CO_2 per copy.
3. Add **printing + finishing** emissions. You can treat these as a processing factor (kg CO_2e per kg paper) or get a figure from your printer.
4. Add **distribution (delivery)** emissions per copy — this is usually small per copy but depends on how you deliver (postal bulk, routed van rounds, door-to-door, EV vs diesel, average km, density of houses per route).
5. Multiply the per-copy total by the number of copies (16,000).

Worked example (transparent assumptions)

Assumptions

- Size: A5, 12 pages → **paper mass ≈ 15 g per copy** (calculation shown below).
- Paper GSM: **80 g/m^2** (common). If you use coated/glossy or heavier stock, use 90–115 gsm — that increases mass.
- Paper production emission factor (kg CO_2e / kg paper):
    - Recycled: **≈ 1.0** (kgCO_2e/kg)
    - Mixed: **≈ 1.5**
    - Virgin: **≈ 2.5**
      (I show three cases so you can see the range.)
- Printing + finishing (energy, inks, press): **0.20 kg CO_2e per kg paper** (applied as a simple processing factor).
- Distribution (last-mile + network) per copy: use a plausible **range 0.005 — 0.03 kg CO_2e per copy** (5–30 gCO_2e) depending on delivery method and vehicle efficiency.

Paper mass calculation (digit-by-digit)

- A5 area per sheet = 0.148 m × 0.210 m = 0.03108 m^2
- 12 pages (both sides) → 6 sheets → total area per copy = 6 × 0.03108 = **0.18648 m^2**
- At 80 g/m^2: mass per copy = 0.18648 m^2 × 80 g/m^2 = **14.9184 g ≈ 15 g → 0.015 kg per copy**

Per-copy emissions

- Paper CO_2 per copy = mass (kg) × paper factor (kgCO_2e/kg)
    - Recycled: 0.015 × 1.0 = **0.015 kg CO_2e** (15 g)
    - Mixed: 0.015 × 1.5 = **0.0225 kg CO_2e** (22.5 g)
    - Virgin: 0.015 × 2.5 = **0.0375 kg CO_2e** (37.5 g)
- Printing per copy = 0.015 × 0.20 = **0.003 kg CO_2e** (3 g)
- Add distribution (low/high): 0.005 — 0.03 kg CO_2e (5–30 g)

Total per copy (low → high)

- Recycled paper case: 0.015 + 0.003 + 0.005 = **0.023 kg** → up to 0.048 kg CO_2e
- Mixed paper case: 0.0225 + 0.003 + 0.005 = **0.0305 kg** → up to 0.0555 kg CO_2e
- Virgin paper case: 0.0375 + 0.003 + 0.005 = **0.0455 kg** → up to 0.0705 kg CO_2e

Total for 16,000 copies

- Recycled: **≈ 368 — 768 kg CO_2e** (0.37 — 0.77 tonnes CO_2e)
- Mixed: **≈ 488 — 888 kg CO_2e** (0.49 — 0.89 tonnes CO_2e)
- Virgin: **≈ 728 — 1,128 kg CO_2e** (0.73 — 1.13 tonnes CO_2e)

So, with these plausible assumptions you're typically in the order of **a few hundred kilograms to about one tonne of CO_2e** for printing + delivering 16,000 A5 12-page copies. Per household that's roughly **0.02–0.07 kg CO_2e per copy** (20–70 g CO_2e each).

How to make this estimate more accurate (what to ask/measure)

If you want a more precise number, get these specifics:

- Exact paper GSM and % recycled content (paper supplier can give the KgCO_2e/kg or an environmental product declaration).
- Exact print run specs: coated paper, binding, varnish (these add emissions).

- Printer LCA or printing emissions factor (many printers can provide a carbon footprint per 1,000 copies or per kg paper).
- Delivery method: postal bulk drop vs dedicated courier vs carrier rounds; vehicle types (diesel/EURO class vs EV), total route km, delivery density (houses per km).