

Daily Activities Contributing to Greenhouse Gas Emissions

This report categorizes everyday activities by major sources of CO₂e emissions. Each item lists a method to estimate its emissions using common factors or formulas, with relevant sources. Where available, South Africa-specific data (e.g. grid factors) are noted.

1. Transportation

Human travel is a major CO₂ source. Emissions are estimated by distance, fuel burn, and passenger occupancy. Common formulas use $CO_2 = distance \times EF$ or $fuel\ used \times EF$. Typical emission factors (EF) include: ~0.17 kgCO₂/km for an average petrol car ¹ (≈ 2.3 kg CO₂ per liter of petrol ²), ~0.17 kg/km for a diesel car, ~0.11 kg/km for a motorbike ³. Public transit generally emits less per person: - **Driving a petrol car (average):** $CO_2 = distance\ (km) \times 0.17\ kg/km$. (≈ 0.20 kg/km) ¹ ².

- **Driving a diesel car:** $CO_2 = distance \times 0.17\ kg/km$ (diesel EF ≈ 0.17 kg/km). (≈ 0.10 – 0.15 kg/km if fuel use known.)

- **Electric car:** $CO_2 = distance \times (energy\ use\ kWh/km) \times (grid\ EF)$. E.g. $0.15\ kWh/km \times 0.967\ kg/kWh \approx 0.15$ kg/km (grid EF for South Africa ~ 0.97 kg/kWh ⁴).

- **Motorcycle:** $CO_2 = distance \times 0.11\ kg/km$ ³.

- **Taxi/Uber (car):** same as above per km.

- **City bus (per passenger):** $CO_2 = distance \times 0.089\ kg/passenger-km$ ⁵ (≈ 0.09 kg/km, UK average). If measuring per vehicle: a typical diesel bus emits ≈ 1.3 kg/km ⁶, but allocated per passenger ~ 0.09 kg/km on average.

- **Coach (long-distance bus):** similar to city bus per passenger (~ 0.08 kg/passenger-km).

- **Commuter rail (electric train):** $CO_2 = distance \times 0.035\ kg/passenger-km$ ⁷ (≈ 35 g/km) reflecting modern rail.

- **Domestic flight:** $CO_2 = distance \times 0.15$ – $0.25\ kg/km$. Short flights use more per km (e.g. ~ 0.25 kg/km ⁷), long-haul ~ 0.10 – 0.15 kg/km ⁸ ⁷. Equivalently ~ 90 – 250 kg CO₂ per flight hour (including radiative forcing) ⁹ ⁸.

- **International flight (long-haul):** $CO_2 = distance \times 0.10$ – $0.12\ kg/km$. (≈ 0.10 kg/km for efficient long flights ⁹).

- **Subway/metro (electric):** Similar to commuter rail, typically ~ 0.02 – 0.05 kg/pass-km depending on grid.

- **Walking or cycling:** negligible on their own (only diet-related emissions).

2. Food and Diet

Dietary choices vary widely in emissions. Emissions are estimated by weight of food consumed: $CO_2 = amount\ (kg) \times EF\ (kg\ CO_2/kg\ food)$. Key averages (global/Poor&Nemecek data) are ¹⁰ ¹¹:

- **Beef (ruminant meat):** ≈ 60 kg CO₂/kg meat ¹⁰ (100 kg with methane, 51 kg excluding methane ¹¹). For 100 g beef: ~ 6 kg CO₂.

- **Lamb/mutton:** > 20 kg CO₂/kg ¹⁰ (often ~ 20 – 40 kg).

- **Pork:** ~7 kg CO₂/kg ¹² . For 100 g pork: ~0.7 kg CO₂.
- **Poultry (chicken, turkey):** ~6 kg CO₂/kg ¹³ . (≈0.6 kg CO₂ per 100 g).
- **Cheese:** >20 kg CO₂/kg ¹² (e.g. ~21 kg/kg).
- **Dairy milk (cow's):** roughly 1–2 kg CO₂ per liter (farm-gate ~1.2–2.4 kg/L) ¹⁴ . (No South African source found.)
- **Eggs:** ~4 kg CO₂/kg (≈0.4 kg per 100 g; estimate from life-cycle studies).
- **Vegetables and fruits:** ~1–2 kg CO₂/kg (plants, varies by type).
- **Legumes/beans:** ~0.9–2 kg CO₂/kg.
- **Rice (paddy):** ~2.7 kg CO₂/kg (plus methane, sometimes reported ~20–25 kg CO₂e/kg due to CH₄) ¹⁵ .
- **Grains (wheat, bread):** ~1–2 kg CO₂/kg.
- **Coffee (ground):** ~0.15 kg CO₂ per cup (≈20 g beans at 7.5 kg/kg).
- **Tea:** ~0.02–0.05 kg CO₂ per cup (tea leaf footprint ~0.5 kg/kg).
- **Beer:** ~0.18 kg CO₂ per 500 ml (varies by production). Wine: ~0.35 kg/liter.
- **Eating one meal (mixed):** sum of above by ingredients. Use recipe weights.

Food waste: Discarded food carries the full production footprint plus methane from landfill. A rough estimate is ~0.5–1 kg CH₄ per kg food waste (→14–28 kgCO₂e) ¹⁶ , plus upstream CO₂. (Specific formula depends on waste handling.)

3. Home Energy Use

Home energy (electricity, heating, appliances) is usually calculated by energy consumption × emission factor. South Africa's grid is carbon-intensive (~0.97 kg CO₂/kWh) ⁴ . Example activities:

- **Electricity usage (general):** CO₂ = kWh × 0.97 kg/kWh (SA grid) ⁴ . (E.g. a 100 W lamp for 10 hours uses 1 kWh ≈ 0.97 kg CO₂.)
- **Electric heating or AC:** CO₂ = power (kW) × hours × 0.97 kg/kWh. (E.g. 2 kW heater for 5 h ⇒ 10 kWh ~9.7 kg CO₂.)
- **Gas heating (e.g. LPG):** ~2.7 kg CO₂ per liter LPG (same principle as petrol) ² . Use volume or energy (1 kWh gas ~0.2 m³).
- **Water heating (electric):** CO₂ = kWh used × 0.97. (E.g. heating 150 L by 40°C ~1.7 kWh → ~1.7 kg CO₂.)
- **Electric stove/oven:** CO₂ = kWh × 0.97. (E.g. 2 kW oven for 1 h ≈ 2 kWh → ~1.9 kg CO₂.)
- **Gas stove/oven:** use LPG EF (≈2.7 kg/kg fuel).
- **Lighting:** e.g. 10 W LED for 5 h = 0.05 kWh (~0.05 kg CO₂).
- **Refrigerator:** typical 0.5–2 kWh/day ⇒ ~0.5–2 kg CO₂/day.
- **Washing machine (electric):** ~0.3–0.5 kWh per wash (modern eco-mode) ⇒ 0.3–0.5 kg CO₂/wash.
- **Tumble dryer:** ~2.5 kWh per cycle ⇒ ~2.5 kg CO₂/cycle ¹⁷ .
- **Dishwasher:** ~0.75–1 kWh per eco cycle ⇒ ~0.7–1 kg CO₂/load. (Plus embodied ~0.1 kg/load ¹⁸ .)
- **Electronics** (TV, PC, charging): e.g. laptop 0.05 kWh/h ~0.05 kg/h; smartphone charge ~5 Wh ~0.005 kg.

4. Consumption and Waste

Manufacturing and disposal of goods generate emissions. Estimate by product weight × EF (kg CO₂/kg product). Examples:

- **Clothing – T-shirts:** ~7 kg CO₂ per shirt ¹⁹ . (Using 0.2 kg cotton at 35 kg CO₂/kg plus processing.)
- **Clothing – jeans:** ~20–25 kg CO₂ per pair (cotton farming, processing).
- **Fast-fashion garment:** 5–10 kg CO₂ each. (Depends on fabric; see carbonfact report.)

- **Electronic devices – smartphone:** ~70 kg CO₂ (production) ¹⁹ ; **tablet:** ~100 kg; **laptop:** ~150–300 kg ²⁰ .
- **Furniture (wood):** ~150 kg CO₂ per 100 kg (harvest and transport).
- **Plastic shopping bag (single-use):** ~0.2 kg CO₂/bag ²¹ . (Plastic production ~6 kg/kg ²² ; ~32 g bag → ~0.2 kg CO₂.)
- **Paper shopping bag:** ~0.1–0.15 kg CO₂ (when single-use).
- **Plastic water bottle (0.5 L PET):** ~0.06 kg CO₂ (≈20 g plastic ×6 kg/kg).
- **Food packaging (plastic/metal):** ~1–2 kg CO₂ per kg of packaging; calculate by material weight.
- **Paper:** ~1.3 kg CO₂ per kg (pulp and mill) plus recycling credit.
- **Disposable cup (paper):** ~0.01–0.1 kg each, depending on insulation layers.
- **Electronics waste:** end-of-life has small emissions, but recycling saves ~2.5 kg CO₂/kg plastic ²³ .
- **Buying a car:** ~6,000 kg CO₂ (manufacturing) for a small car. (Amortize over ~10 years.)
- **Renovation/construction:** e.g. cement 0.9 kg CO₂/kg; steel 1.85 kg/kg.

Waste disposal:

- **Landfilling food waste:** roughly 1 kg food → 0.5 kg CH₄ on decay → ~14 kg CO₂e, plus original food's footprint.
- **Recycling** saves: ~2–3 kg CO₂/kg plastic recycled ²³ .

5. Water Usage

Water treatment and heating have carbon costs. Emissions arise from pumping, treating, and especially heating water.

- **Showering:** ~0.115 kg CO₂ per minute ¹⁶ (based on heating ~7 L/min to 55°C). So 6 min shower ≈0.69 kg CO₂ ¹⁶ . *Formula:* volume (L)×temperature rise (°C)×4.18 J/g°C, convert to kWh and ×0.97 kg/kWh.
- **Bath (150 L at 40°C):** ~1.5 kg CO₂ (≈1.7 kWh heating).
- **Handwash dishes:** depends on water volume and heat. E.g. 10 L at 50°C ≈0.6 kWh → ~0.6 kg CO₂.
- **Dishwasher:** included above (0.7–1 kg/load).
- **Laundry machine:** included above (0.3–0.5 kg for wash, plus dryer if used).
- **Garden watering:** electricity for pumping (0.2–0.5 kWh per day) or fertilizer production.
- **Drinking tap water:** negligible unless boiled (see cooking). Bottled water: ~0.5 kg CO₂ per liter (bottle and transport).

6. Digital Habits

Data and devices consume energy. Emissions are often small per use, but can accumulate:

- **Video streaming:** ~0.036 kg CO₂ per hour ²⁴ (IEA, 2019); or 0.055 kg/h in Europe ²⁵ . *Formula:* hours streamed×0.04 kg/h. (Includes data centers, networks, devices.)
- **Audio streaming/music:** ~0.001 kg (1 g) CO₂ per hour ²⁶ . (Much lower data rate.)
- **Sending 1 email:** ~0.2–0.3 g CO₂ ²⁷ (short email on laptop). A long email can be ~17 g ²⁷ . *Formula:* emails×~0.0003 kg.
- **Video conferencing:** ~0.01 kWh per hour (depending on device) → ~0.01 kg CO₂/h (negligible).
- **Cloud storage:** ~0.2 kg CO₂ per GB per year (estimate, varies).
- **Web browsing/social media:** ~0.02 kg/h (assume 0.01–0.05 kWh use).
- **Gaming (console/PC):** ~0.1–0.3 kWh/h → 0.1–0.3 kg CO₂/h (on coal grid).
- **Blockchain/crypto (personal use):** negligible unless mining.

7. Work and Commuting Patterns

Work-related travel and office energy also emit CO₂:

- **Commuting (private vehicle):** as per *Transport* above. E.g. 30 km round-trip $\times 0.17$ kg/km ≈ 5.1 kg CO₂/day.
- **Commuting (public transit):** use bus/train factors above. Example: 20 km train commute $\times 0.035$ kg/km ≈ 0.7 kg CO₂/day.
- **Business air travel:** count as flights above. E.g. one 1-hour flight ~ 0.25 tCO₂.
- **Remote work (WFH):** reduces commuting but may increase home energy. Net: commute emissions saved minus incremental home usage (e.g. heating, lighting).
- **Office building:** per-person lighting/heating. Example: 100 W of lighting for 8h ~ 0.8 kWh (~ 0.8 kg CO₂) per workday.
- **Video meetings:** as digital use above.
- **Paper vs. digital office:** printing has paper/fuel costs; store data has digital costs (see Digital).

Formulas and Methods: In all cases, use activity data (distance, quantity, time) multiplied by an emission factor. For example, **CO₂ (kg) = Activity \times EF (kg/unit)**. Where possible, use local values (e.g. grid EF ≈ 0.97 kg/kWh in South Africa ⁴) or international averages with citations.

Sources: Emission factors and estimates are drawn from government and scientific sources ¹ ² ⁵ ⁷ ⁸ ¹⁰ ¹¹ ⁴ ¹⁹ ²¹ ²⁶ ²⁴ ²⁷. These allow CO₂-equivalent calculation for each activity as shown.

¹ Emission Factor: Petrol car (average) - Passenger vehicles | Transport | Vehicles | United Kingdom | Climatiq

<https://www.climatiq.io/data/emission-factor/5cc66c6a-b273-471a-b378-c974ef8a6df4>

² MetLink - Royal Meteorological Society Carbon Footprint - Information Sheet -

<https://www.metlink.org/resource/carbon-footprint-information-sheet/>

³ Emission Factor: Motorbike (average) - Business travel | Transport | Vehicles | United Kingdom | Climatiq

<https://www.climatiq.io/data/emission-factor/99856a30-786a-47ae-ba13-d6c601d63167>

⁴ Emission Factor: Electricity supplied from grid | Energy | Electricity | South Africa | Climatiq

<https://www.climatiq.io/data/emission-factor/70811bd8-2827-4e75-a87e-f801f5be3bda>

⁵ ⁶ Emissions from bus travel

<https://www.carbonindependent.org/20.html>

⁷ Which form of transport has the smallest carbon footprint? - Our World in Data

<https://ourworldindata.org/travel-carbon-footprint>

⁸ ⁹ Aviation sources

https://www.carbonindependent.org/sources_aviation.html

¹⁰ ¹² ¹³ You want to reduce the carbon footprint of your food? Focus on what you eat, not whether your food is local - Our World in Data

<https://ourworldindata.org/food-choice-vs-eating-local>

11 15 The carbon footprint of foods: are differences explained by the impacts of methane? - Our World in Data

<https://ourworldindata.org/carbon-footprint-food-methane>

14 Milk (Cow) Carbon Footprint | 0.8kg CO₂e - CO₂ Everything

<https://www.co2everything.com/co2e-of/milk>

16 Shower | co2data.org

<https://www.co2data.org/c/shower>

17 Find out the Carbon Footprint of Common Items

<https://clevercarbon.io/carbon-footprint-of-common-items>

18 Dishwasher or Hand-washing? Which is better for the environment? ~ Crafty Cabbage

<https://www.craftycabbage.com/2021/10/dishwasher-or-hand-washing-which-is.html>

19 How much carbon is a t-shirt? / Carbonfact

<https://www.carbonfact.com/blog/tshirt>

20 Assessing embodied carbon emissions of communication user ...

<https://www.sciencedirect.com/science/article/pii/S1364032123002794>

21 22 23 Plastic bags and plastic bottles - CO₂ emissions during their lifetime - Time for Change

<https://timeforchange.org/plastic-bags-and-plastic-bottles-co2-emissions-during-their-lifetime/>

24 The carbon footprint of streaming video: fact-checking the headlines – Analysis - IEA

<https://www.iea.org/commentaries/the-carbon-footprint-of-streaming-video-fact-checking-the-headlines>

25 The Carbon Cost of Streaming - Greenly

<https://greenly.earth/en-us/leaf-media/data-stories/the-carbon-cost-of-streaming>

26 Spotify's rising carbon footprint from turning audio into video

<https://podnews.net/press-release/spotify-video-environment>

27 The Carbon Cost of an Email: Update! - The Carbon Literacy Project

<https://carbonliteracy.com/the-carbon-cost-of-an-email/>