

Printing Carbon Footprint Calculator: Key Assumptions



1. “The Carbon Footprint Calculator generates estimates of energy consumption during use of a printer, emissions of carbon dioxide from production of that electricity, and carbon dioxide emissions from production of estimated volumes of paper consumed during printing (i.e. estimated CO₂ from electricity production and CO₂ from paper production). The Carbon Footprint Calculator also estimates the user’s costs for the electricity and paper a printer consumes. It is based on certain key assumptions and makes use of data and models generated by third parties described below.
2. The carbon dioxide equivalent (CO₂-e) results are for a 100 year global warming potential (GWP) horizon if default emission factors are employed by the user.
3. The energy consumption calculation assumes the printer has an 8 hour “workday” 5 days a week for every week in a year. When the printer is not printing during the workday, it is assumed that the balance of the workday is spent half in ready mode and half in sleep mode. The balance of the week is assumed to be spent in sleep mode. Device is assumed to print at its maximum monochrome speed. The energy figure reported is the sum of the printing energy, the workday standby energy, the workday sleep energy, and the non-workday sleep energy for the chosen time period.

4. The electricity carbon dioxide equivalent (CO₂-e) factors used in the calculations comes from the following sources:

| Region | Note |
|--|---|
| All regions unless otherwise noted below | 2009 CO ₂ Emissions per kWh from Electricity and Heat Generation. Source: CO ₂ Emissions from Fuel Combustion. 2011 Edition. International Energy Agency Available at iea.org/publications/freepublications/publication/co2emissionfromfuelcombustionhighlights.pdf . |
| Australia | 2013 Full fuel cycle emissions factor. Sources: National Greenhouse and Energy Reporting (Measurement) Amendment Determination 2013 (No.1) and the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines July 2013. Source: National Greenhouse Accounts Factors—July 2013, Commonwealth of Australia, Department of Climate Change. Available at climatechange.gov.au/climate-change/greenhouse-gas-measurement-and-reporting/tracking-australias-greenhouse-gas-emissions/national-greenhouse-accounts-factors%E2%80%94july-2013 Overall Australian CO ₂ emissions factor a population weighted average. |
| Canada | Source: Greenhouse Gas Division, Environment Canada, National Inventory Report, Greenhouse Gas Sources and Sinks in Canada - 1990-2005. (Submission to the United Nations Framework Convention on Climate Change), 2007, Tables A9-1 through A9-12. |
| United Kingdom | Energy Suppliers' Fuel Mix Disclosure from 1 April 2009 to 31 March 2010. Source: Consumer Focus. Available at gov.uk/government/collections/fuel-mix-disclosure-data-tables . |
| United States | Year 2010 Data. Source: "eGRID 9th edition Version 1.0 State File (Year 2010 Data), United States of America, Environmental Protection Agency. Available at epa.gov/cleanenergy/energy-resources/egrid/index.html . |

5. The default plain paper carbon dioxide equivalent (CO₂-e) factor used in the calculator is 1.9 kg CO₂-e per kg of plain paper. Source: Printing and Writing Papers Life Cycle Assessment Summary Report. American Forest & Paper Association, 2011, retrieved from afandpa.org/docs/default-source/default-document-library/printing-and-writing-lca-report.pdf?sfvrsn=0. The study assumes (based on data from the U.S. EPA) that 71.8% of office paper is recovered, 5.2% is burned for energy, and 23% is land filled. The study also assumes that 4% of the fiber needed to produce the office paper comes from recovered fiber.
6. The currency list and exchange rates used in the calculations are from bloomberg.com/markets/currencies/americas_currencies.html on 12/15/2017.
7. The default electrical costs used in the calculations are for a regional average of industrial sector prices, or commercial prices where available, in 2008, except for the US which uses data from 2015. EIA Table 5.3 "Average retail price of electricity to ultimate customers" Source: eia.doe.gov/emeu/international/elecprii.html.
8. The default pages printed per employee assumption is according to the Lawrence Berkeley National Laboratory which states that the average US office worker uses 10,000 sheets of paper per year. Source: Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory, United States Department of Energy, Available at: eetd.lbl.gov/paper/ideas/html/uspaperuse.html.
9. The calculations assume that a "page" of paper is A size, 75 gsm weight. Each page is estimated to cost \$0.008 (USD).
10. The "Powering off daily" scenario assumes that the device is put into an "off" power state via a switch at the end of every work day. The off power used in the calculations of 0.4 Watts is for the average of the entire 2008 HP LaserJet printer and MFP lineup.
11. The "HP Web Jetadmin" scenario assumes that each device in the fleet works with WJA. This scenario modifies the Current Fleet energy calculation such that each printer requires 29 minutes at the end of each work-day in standby mode prior to reaching sleep mode. The New Fleet uses WJA to automatically send each device into its sleep state at the end of every workday and thus retains the default energy calculation. The default time to sleep given is for the average of the entire 2008 HP LaserJet printer and MFP lineup.

12. The “HP Universal Print Driver to increase your duplex rates” assumes that all devices in the fleet can use UPD and have built-in duplexers. It also assumes a paper savings rate resulting from duplexing of 25% based on HP’s internal study of UPD.
13. The “Pull printing” scenario assumes that all devices in the fleet have some means of Pull-printing, either from HP or a third-party. It assumes a paper savings rate of 10% resulting from pull printing. Source: Gartner. “Cost Cutting Initiatives for Office Printing.” Sharon McNee. 22 February 2008.
14. The Designjet media calculations assume A1/D size media. Each sheet of plain A1/D is assumed to be 80 gsm and cost \$0.28, and each sheet of photo A1/D is assumed to be 235 gsm and cost \$1.73.
15. The default photo paper carbon dioxide equivalent (CO₂-e) factor of 2.5 kg CO₂-e per kg of photo paper used in the calculations is for a 100 year GWP horizon. The figure is for a 233 g/m² media that is comprised of natural fibers, a silica coating and polyethylene. The figure was calculated through an ISO 14040/14044 compliant life cycle assessment commissioned by HP.
16. Some Designjets have an integrated printing file processor that increases energy usage. It avoids the need for a separate, dedicated computer to undertake this file processing, and so may help to lower overall energy consumption.
17. HP Smart Print is a free tool that helps you save paper and ink by printing only the web content you need.¹ By using the free HP Smart Print tool, you can reduce your paper use by up to 55%. Supports Microsoft® Internet Explorer 7.0, 8.0, and 9.0, as well as Firefox versions 3.5 through 5.01. An independent study commissioned by HP compared paper consumption using HP Smart Print with a web browser’s print command. Microsoft® Internet Explorer users can save up to 55% and Mozilla Firefox users (tested on version 3.6.19) can save up to 15% on paper.
18. For HP PageWide enterprise-class devices default power consumption during sleep device settings may vary by region. For the purpose of this calculation the lowest sleep setting for power consumption is used. Settings may be changed by the user to optimize device performance for their specific needs for energy efficiency vs. first page out speeds. At the lowest power consumption setting for sleep, the first page printed may be delayed by a few seconds vs a sleep setting using the highest power consumption setting. Actual power consumption varies based on power settings selected, pages printed, and other factors.

