Indirect CO_2 Emissions from the Consumption of Purchased Electricity, Heat, and/or Steam

Guide to calculation worksheets (January 2007) v 1.2

A WRI/WBCSD GHG Protocol Initiative calculation tool

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I. Overview

I.A. Purpose and domain of this tool

This tool intends to facilitate the calculation of indirect CO_2 emissions attributable to the consumption of purchased electricity, heat, and/or steam. **This document is to be used in conjunction with "Calculation worksheets – Indirect CO_2 emissions from the consumption of purchased electricity, heat, and/or steam"**, which can be downloaded from the GHG Protocol Initiative website, www.ghgprotcol.org.

Depending on circumstances, this tool may also be used in conjunction with up to six additional documents and tools, which can also all be downloaded from the GHG Protocol Initiative website. These documents and tools include:

- "The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)";
- "Calculation worksheets – Direct emissions from stationary combustion";
- "Guide to calculation worksheets – Direct emissions from stationary combustion";
- "Calculation worksheets – Allocation of CO_2 emissions from a combined heat and power (CHP) plant";
- "Guide to calculation worksheets – Allocation of CO_2 emissions from a combined heat and power (CHP) plant"; and
- "Working 9 to 5 on Climate Change (Revised Edition)".

A step-by-step approach is used to cover every phase of the calculation process from data gathering to reporting.

This is a cross-sector tool, which should be applied by all companies whose operations involve the consumption of purchased electricity, heat, and/or steam. The tool is regularly updated to incorporate the emerging best practices and state-of-art guidance on quantification methodologies and emission factors.

I.B. Process description

Electricity, heat, and/or steam are produced when fossil fuels are burned in stationary combustion units or when other fuel sources (e.g., nuclear, hydro, wind, solar, etc.) are harnessed to produce energy. GHG emissions that result from the consumption of purchased electricity, heat, and/or steam, are emitted directly through the combustion of fossil fuels in stationary combustion units. These GHG emissions include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Sources of emissions from stationary combustion include boilers, heaters, furnaces, kilns, ovens, dryers, and any other equipment or machinery that uses fuel. Further information on stationary combustion emissions and calculation methodologies is available in the revised "Direct emissions from stationary combustion" calculation worksheets and guidance document, which can be downloaded from the GHG Protocol Initiative's website, www.ghgprotocol.org.

While GHG emissions that result from the consumption of purchased electricity, heat, and/or steam are physically emitted at the facilities where the electricity, heat, and/or steam are generated

(i.e., stationary combustion units), the emissions are still a consequence of the activities of the consumer that purchases the electricity, heat, and/or steam. Therefore, GHG emissions from the consumption of purchased electricity, heat, and/or steam are considered to be "indirect" emissions, as they are the indirect consequence of the purchase and consumption of electricity, heat, and/or steam, although the emissions physically occur at sources owned or controlled by another company.

I.C. Estimation method used in the tool

This tool is based on the emission factor-based methodology, which is the most appropriate and practical method to measure GHG emissions associated with the consumption of purchased electricity, heat, and/or steam.

The emission factor-based methodology estimates GHG emissions by multiplying a level of activity data (e.g., kWh of electricity consumed by a facility) by an emission factor (e.g., grams of CO_2 per kWh). Part II of this guidance document provides further information on determining the most appropriate activity data and emission factors.

I.D. Applicability of the tool

Although CO_2, CH_4, and N_2O are emitted during the combustion of fossil fuels, CO_2 accounts for the majority of greenhouse gas emissions from most stationary combustion units that generate electricity, heat, and/or steam. When weighted by their global warming potential (GWP)[1], CO_2 typically represents over 99 percent of the greenhouse gas emissions from the stationary combustion of fossil fuels. The approach required to estimate CO_2 emissions differs significantly from that required to estimate CH_4 and N_2O emissions. While CO_2 can be reasonably estimated by applying appropriate emission factors to the fuel quantity consumed, estimating CH_4 and N_2O depends not only upon fuel characteristics, but also on technology type and combustion characteristics, usage of pollution control equipment, and ambient environmental conditions. Emissions of these gases also vary with the size, efficiency, and vintage of the combustion technology, as well as maintenance and operational practices. Due to this complexity, a much greater effort is required to estimate CH_4 and N_2O emissions from the consumption of purchased electricity, heat, and/or steam, and a much higher level of uncertainty exists. This tool therefore only includes guidance for estimating CO_2 emissions from the consumption of purchased electricity, heat, and/or steam.[2]

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[1] Different GHGs vary in their ability to trap heat in the atmosphere and therefore some GHGs are more harmful to the climate than others. Each GHG has a "global warming potential" or "GWP" which refers to this heat-trapping ability relative to carbon dioxide (CO_2). For example, CO_2 – which has a GWP of 1 – is the most prevalent GHG but methane (CH_4) is 21 time more damaging, thus the GWP of methane is 21. GHGs should be reported as CO_2 or CO_2-equivalents (CO_2-e). Emissions factors for most sources of emissions can be found in these units.

[2] The GHG Protocol Initiative's "Direct emissions from stationary combustion" calculation worksheets and guidance document provides some basic guidance for calculating CH_4 and N_2O from fuel consumption. This tool is available on the GHG Protocol Initiative website, www.ghgprotocol.org. Also, the US EPA Climate Leaders program provides electricity emission factors for CH_4 and N_2O for U.S. power pool regions in the Core Module Guidance for Indirect Emissions from Purchases/Sales of Electricity and Steam (pp. 20-21). http://www.epa.gov/climateleaders/docs/indirectelectricityguidance.pdf.

II. Organizational and operational boundaries

Before identifying and calculating a company's GHG emissions, it is important to define the company's organizational and operational boundaries. This enables a company to determine which business units and which company activities that result in GHG emissions will be included in the company's GHG emissions inventory. While limited guidance on setting organizational and operational boundaries is provided below, it is strongly suggested that companies refer to the GHG Protocol Corporate Accounting and Reporting Standard, revised edition (referred to as the "Corporate Standard" throughout the rest of this document), which is available on the GHG Protocol Initiative website, for more in-depth guidance when planning a GHG inventory.

II.A. Organizational boundaries

Chapter 3 of the Corporate Standard provides guidance on determining which of a company's business units should be included in its GHG inventory. This process is known as setting a company's "organizational boundary". Two approaches can be used to establish a company's organizational boundary: the "equity share" and the "control" approach.

Equity share approach – A company accounts for GHG emissions from operations according to its share of equity in an operation.

Control approach – A company accounts for 100 percent of the GHG emissions from operations over which it has control.

- **Financial control** – A company has financial control over an entity if the company can direct the financial and operating policies of the entity to gain the economic benefits of the entity's activities.
- **Operational control** – A company has operational control over an entity if the company or any of its subsidiaries has the ability to introduce and implement operating policies at the entity.

II.B. Operational boundaries

Chapter 4 of the Corporate Standard provides guidance on identifying emissions associated with its operations, categorizing them as direct or indirect emissions, and choosing the "scope" of the emissions. This process is known as setting a company's "operational boundary", and enables a reporting company to determine which activities that result in GHG emissions should be included in its GHG inventory.

Direct GHG emissions are emissions from sources that are owned or controlled by the company. Direct GHG emissions are classified as "scope 1" emissions. GHG emissions from the combustion of fossil fuels in stationary combustion units should be classified and reported as "scope 1" direct emissions by the company that owns or controls the stationary combustion units. *This tool should not be used to calculate direct emissions*; instead, use the GHG Protocol Initiative's "Direct emissions from stationary combustion" calculation worksheets and guidance document, which are available on the GHG Protocol Initiative website.

Indirect GHG emissions are emissions that are a consequence of the activities of a company but, occur at sources owned or controlled by another company. Indirect emissions include "scope 2" and "scope 3" emissions. Scope 2 emissions account for GHG emissions from the consumption of purchased electricity, heat, and/or steam at a facility that falls within a company's organizational boundary. This tool should be used to calculate Scope 2 indirect emissions associated with the consumption of purchased electricity, heat, and/or steam.

Scope 3 emissions include all other indirect GHG emissions, whether or not they fall within a company's organizational boundary. This tool should also be used to calculate Scope 3 indirect emissions associated with the consumption of purchased electricity, heat, and/or steam (See II.C. Dealing with leased facilities).

The Corporate Standard requires that all scope 1 and scope 2 emissions be accounted for and reported, while accounting for and reporting scope 3 emissions is optional.

II.C. Dealing with leased facilities

Many companies lease building or facility space and must decide how to account for and report GHG emissions associated with purchased electricity from leased space. To determine how to account for and report GHG emissions associated with leased assets, please follow the guidelines in Annex F of the GHG Protocol Corporate Standard, "Categorizing GHG Emissions Associated with Leased Assets", which can be found as a stand-alone document on the GHG Protocol website, www.ghgprotocol.org.

II.D. Accounting for purchased electricity, heat, and/or steam for resale

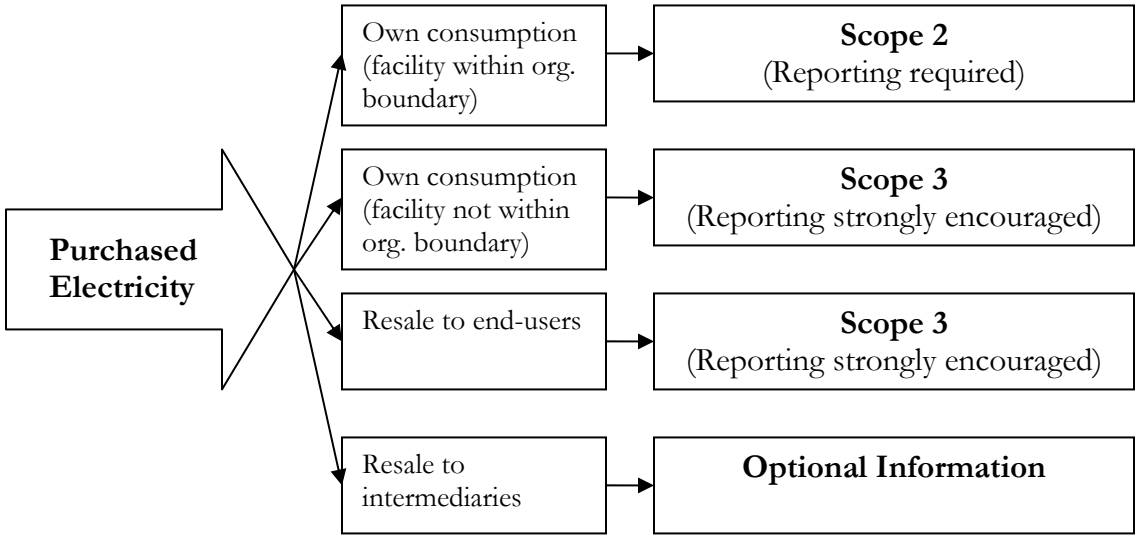
While this tool focuses on purchased electricity, heat, and/or steam for consumption, some companies purchase electricity, heat, and/or steam for resale to either end-users or intermediaries. Purchased electricity, heat, and/or steam for resale to end-users should be classified as scope 3 indirect emissions, and according to GHG Protocol standards, it is optional, but strongly encouraged, to account for and report these emissions. Purchased electricity, heat, and/or steam for resale to intermediaries should be classified and reported separately as "optional information". This tool can be used to calculate emissions associated with purchased electricity, heat, and/or steam for resale.

II.E. Accounting for transmission and distribution losses

It is often the case that a significant portion (between 5% in OECD countries and up to 20% in developing countries) of electricity is consumed during its transmission and distribution to end-users (T&D loss). Emissions from the generation of purchased electricity that is consumed during transmission and distribution should be reported as scope 2 indirect emissions by the company that owns or controls the T&D operation. Therefore, unless a company that purchases electricity, heat, and/or steam owns or controls the T&D operation, T&D loses should not be included in the company's GHG inventory. Please refer to Chapter 4 (Setting Operational Boundaries) and Appendix A (Accounting for Indirect Emissions from Purchased Electricity) of the Corporate

Standard for information on treatment of T&D losses.[3] This tool can be used to calculate emissions associated with T&D losses, assuming that the level of electricity loss and necessary emission factors can be determined.[4]

Figure 1. Accounting for indirect GHG emissions associated with purchased electricity



III. Choice of activity data and emission factors

As mentioned in Part I above, this tool uses the emission factor-based methodology, which estimates GHG emissions by multiplying a level of activity data by an emission factor. Activity data is a quantified measure of an activity, such as electricity consumption, and emission factors convert activity data into emission values.

Activity Data x Emission Factor = CO_2 Emissions

III.A. Activity data

The activity data that should be collected to measure GHG emissions using this tool is the quantity of purchased electricity, heat, and/or steam consumed. Electricity consumption is generally measured in kilowatt hours (kWh) or megawatt hours (MWh).[5] Data on heat and/or steam use is

[3] Please note that most emission factors do not account for T&D losses, however it is possible that some emission factors may take T&D losses into account. Users should always check whether or not T&D losses are included in the emission factors used, as this may increase the emission factor. Companies that do not own or control the T&D operation should not use emission factors that account for T&D losses, and if the only emission factors available do account for T&D losses, the company should be transparent and note this in its GHG inventory reporting.

[4] The California Climate Action Registry (CCAR) provides guidance on calculating T&D losses in Chapter 8 of the Power/Utility Reporting Protocol (Appendix X to the General Reporting Protocol). http://www.climateregistry.org/PROTOCOLS/PUP/

[5] 1,000 kilowatt hours (kWh) equals 1 megawatt hour (MWh).

often collected in British thermal units (Btu), joules (J), therms, or pounds, which can then be converted to kWh (see worksheet "Conversion Factors" to covert this data to kWh).

A facility-specific method (calculating the heat and/or steam activity data per facility) that uses fuel purchase records is the only approach available for calculating heat and/or steam activity data. However, several methods exist to collect activity data on the consumption of purchased electricity. A facility-specific method (calculating the electricity activity data per facility) that uses electricity bill/meter records is always the preferred approach. This is often the most accurate approach, and also facilitates the identification of opportunities to reduce emissions. If calculating activity data for electricity use at the facility level using electricity bill/meter records is not possible, as is often the case in leased, office-based facilities that are not owned by the reporting company, estimation methods to approximate activity data for electricity use may be employed.

Four activity data collection methods are listed below for calculating electricity use, including the preferred method and three estimation methods.[6] Table 2 below summarizes these data collection choices as a hierarchy from the most preferred method to the last-resort method. It is important to document the choice of activity data collection method in the inventory and to keep records of purchased electricity, heat, and/or steam.

- Actual electricity or fuel use records method – As mentioned above, this is the preferred and in general most accurate data collection method. For purchased electricity, monthly electric bills or electric meter readings should provide the necessary activity data. For tenants of leased space, particularly in office buildings, electricity costs are frequently included as part of rental payments and accurate electricity use data is often difficult to obtain, as monthly electric bills or electric meter readings may not be available. In this instance, it may be necessary to estimate electricity consumption by following one of the three estimation methods provided below.

  For heat or steam purchases, purchase records should provide the necessary activity data. Please note that the three estimation methods described below are not applicable for heat or steam purchases.

  "Worksheet 1-Standard Method" should be used to calculate CO_2 emissions associated with the consumption of purchased electricity, heat, and/or steam when the "actual electricity or fuel use records method" is used.

- Building-specific data estimation method – If fuel purchase records, electricity bills, or meter readings are not available or applicable, often because the reporting company leases office space in a building owned by another entity, the next best method is to estimate electricity consumption using actual data based on building-specific electricity use records. While this method does use actual building-specific data, this data is not specific to the particular office space in the building used by the reporting company, but only to the entire buildings energy use. Another limitation to this method is that it assumes that all occupants of the building have similar energy consuming habits. For these reasons, this method is considered to be an

[6] It is important to note that when using the three estimation methods, it will not be possible (or very difficult) to track GHG performance improvements that may be achieved over time through energy efficiency or energy conservation measures.

estimation method that is less accurate then the preferred "actual electricity or fuel use records method" described above.

To follow this method, the following information will be necessary, and should be available from the building's property manager:

- Total building area;
- Area of company's space;
- Total building electricity use (in kWh or MWh); and
- Building occupancy rate (i.e., if 75 percent of the building is occupied, then use .75)

Using this information and the following formula, it will be possible to estimate the approximate kWh or MWh of electricity consumption.

(Area of Company's Space ÷ Total Building Area) x Total Building Electricity Use ÷ Building Occupancy Rate = Approximate kWh or MWh Electricity Used

"Worksheet 2-Building Estimation" should be used to calculate CO_2 emissions associated with the consumption of purchased electricity when the "building-specific data estimation method" is used.

- Similar building/facility estimation method – If building-specific electricity use data is not available, it may be possible to develop an estimate of a building's/facility's electricity consumption using actual data extrapolated from other similar buildings/facilities owned by the reporting company. This method should only be used if the reporting company has multiple buildings/facilities of a similar type, with similar electricity use patterns, and is able to obtain accurate, reliable electricity use data for some of them using the "actual electricity or fuel use records method" described above.[7]

  "Worksheet 1-Standard Method" should be used to calculate CO_2 emissions associated with the consumption of purchased electricity when the "similar building/facility estimation method" is used. The reporting company should clearly and transparently justify how this method has been used by documenting all data used and assumptions made.

- Generic building space data method – If building-specific electricity use data or accurate data from other similar buildings/facilities owned by the reporting company is not available, it may be possible to collect default data on kWh used per area of generic office space in a particular country from a published source, such as a government agency.[8] This method is only recommended as a last-resort method, as it serves as a very rough estimate that may be significantly inaccurate. Furthermore, this method should only be used by reporting companies whose CO_2 emissions from electricity use in office space represent a small percentage of the company's total GHG emissions. For office-based companies whose CO_2 emissions from

[7] Note that electricity use for buildings varies significantly based on a number of factors, such as geographic location, building size, building efficiency, building use, and building operating hours.
[8] The US DOE's Energy Information Administration (EIA) publishes this type of regionally-specific data for different types of commercial buildings through its Commercial Building Energy Consumption Survey (CBECS), http://www.eia.doe.gov/emeu/cbecs/contents.html.

electricity use in office space represent a very large percentage of the company's total GHG emissions, this method should not be used.

"Worksheet 1-Standard Method" should be used to calculate CO_2 emissions associated with the consumption of purchased electricity when the "generic building space data method" is followed.

Table 2. Activity data collection methods

Order of Preference	Activity Data Collection Method Name	Activity Being Measured/Estimated	Worksheet to Use
1	Actual electricity or fuel use records method	Electricity, heat, and/or steam use	Worksheet 1-Standard Method
2	Building-specific data estimation method	Electricity use	Worksheet 2-Building Estimation
3	Similar building/facility estimation method	Electricity use	Worksheet 1-Standard Method
4	Generic building space data method	Electricity use	Worksheet 1-Standard Method

III.B. Emission factors

Selecting electricity, heat, and/or steam emission factors

Emissions factors for electricity, heat, and/or steam vary with season, time of day, and supplier. There is also the issue of whether to use marginal or average rates when calculating CO_2 emissions associated with electricity, heat, and/or steam consumption. As it is usually not practical to take all of these variables into account, and as marginal rates are often not widely available, this tool recommends the use of average rates in the calculation of an entity's indirect emissions. Several options for selecting an electricity, heat, and/or steam emissions factor are provided below. If site-specific emission factors are available, they are generally preferable to more generic or general emission factors. Figure 2 below summarizes the data collection choices in order of preference. It is important to remember to express emission factors in the same measurement units as the activity data used in the calculation worksheets. It is also important to document and justify the choice of emission factors used in the inventory.

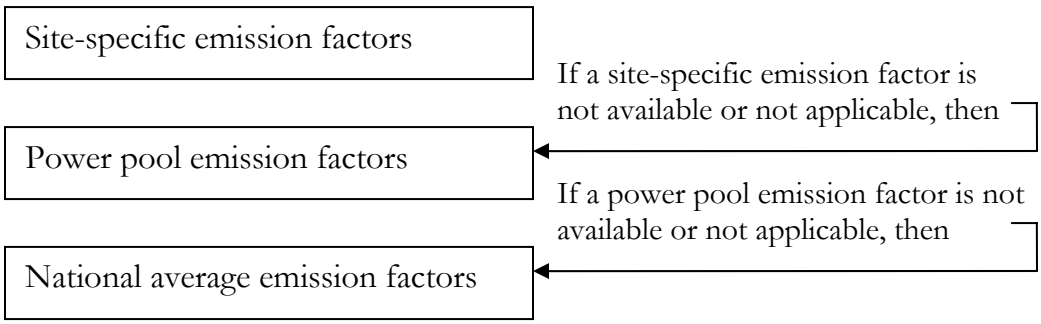
- Site-specific emission factors – This is the most accurate option, but would generally only apply to large industrial customers who have a direct supply and transmission contract with a specific electricity, heat, and/or steam supplier in the vicinity. In this case, the emission factor should be based on the actual fuel fired and the technology employed by the electricity, heat, and/or steam supplier.

- Regional/power pool emission factors – If site-specific emissions factors are not available, use a generic regional or power pool emissions factor that has been published by the government in the country where the facility is located. Government statistics may be aggregated by power pool

region or state. For example, the US EPA's eGRID[9] provides aggregated data for regions and sub-regions of the power grid, as well as information for every power plant and generating company in the US Information on eGRID subregion emission factors (1996-2000) is provided in the worksheet "EFs Electricity US Region". The Canadian GHG Challenge Registry publishes provincial emission factors in the Registry Guide[10]. Regional power pool data is preferable to state data, as transmission and distribution grids often cover multiple states. Power pool data more accurately reflects the generation mix for a region.

- National average emission factors – If regional or power pool emission factors are not available, use an appropriate generic national average factor for the entire country's grid. Information on CO_2/kWh for Annex I and non-Annex 1 countries (1988 onwards) is provided in the worksheet "EFs Electricity Intl All Fuels". If you know what kind of fuel your supplier fires, use the worksheets "EFs Electricity Intl Gas", "EFs Electricity Intl Oil", and "EFs Electricity Intl Coal". These statistics have been developed by the International Energy Agency (IEA)[11] and UNEP[12] and do not include transmission losses.

Figure 2. Hierarchy of emission factor choices



Selecting emission factors for electricity, heat, and/or steam purchases from a combined heat and power plant (CHP)

In a combined heat and power (CHP) system, electricity and steam are generated together from the same fuel supply. Depending on the configuration of the CHP system, a system can generate from between one to two, to up to five times, as much thermal energy as electric energy.

If a company is using all of the energy generation from a particular CHP plant, or using the heat and power streams in the same proportions as they are generated, then the average emission factor obtained by considering total energy generated and total emissions of the plant will be sufficient.

However, in most cases, it will be necessary to assign the CO_2 emissions from the CHP plant to the two (or more) resulting energy streams (electricity and steam). Different methods exist to allocate emissions of CHP plants, including the "efficiency", "energy content", and "work potential"

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9 US EPA, Emissions & Generation Resource Integrated Database (eGRID), http://www.epa.gov/cleanenergy/egrid/index.htm

10 Canadian GHG Challenge Registry, http://www.ghgregistries.ca

11 International Energy Agency (2000), CO_2 Emissions from Fuel Combustion

12 United Nations Environment Program (2000), The GHG Indicator, UNEP Guidelines for Calculating GHG Emissions from Businesses and Non-Commercial Organizations

methods. These methods are explained, along with further guidance and calculation worksheets[13] on determining emission factors for electricity, heat, and/or steam purchases from a CHP plant, in the "Allocation of CO_2 emissions from a combined heat and power (CHP) plant" calculation worksheets and guidance document.

This CHP tool, which is available on the GHG Protocol Initiative website, should be used to determine the appropriate emission factors for each energy stream from a CHP plant. Once these appropriate emission factors for each energy stream are determined, then the "actual electricity or fuel use records method" described in this tool should be applied to "Worksheet 1-Standard Method" in this tool to determine the resulting CO_2 emissions.

IV. Using the calculation worksheets

This guidance document should be used in conjunction with the supplemental Excel-based calculation tool, "Calculation worksheets – Calculating indirect CO_2 emissions from the consumption of purchased electricity, heat, and/or steam", which can be downloaded on the GHG Protocol Initiative website. The Excel-based tool consists of two calculation worksheets, "Worksheet 1-Standard Method" and "Worksheet 2-Building Estimation", several worksheets providing default electricity emission factors, as well as a conversion factor worksheet.

IV.A. Worksheet 1-Standard Method

This worksheet should be used for all calculations using the emission factor-based methodology (activity data x emission factor = CO_2 emissions), except for calculations that follow the "building-specific data estimation method", in which case "Worksheet 2-Building Estimation" should be used. To use Worksheet 1, follow the steps below:

1. Enter activity data from purchased electricity, heat, and/or steam in kWh in column A. If the activity data that has been collected is not in kWh, use the conversion factor worksheet to convert to kWh.
2. Enter the appropriate CO_2 emission factor in column B. Note that the emission factor entered should be entered as grams CO_2/kWh. If the emission factor selected is not in grams CO_2/kWh, use the conversion factor worksheet to convert to grams CO_2/kWh.
3. In column C, the electricity, heat, and/or steam purchase activity data is automatically multiplied by the corresponding emissions factor to obtain indirect CO_2 emissions in metric tons of CO_2.
4. All values in column C are automatically added to provide a total CO_2 emissions value in metric tons of CO_2.

IV.B. Worksheet 2-Building Estimation

This worksheet should be used for calculations that follow the "building-specific data estimation method:"

[13] The "Allocation of CHP emissions" guidance document provides guidance for all three methods, the calculation worksheets are only provided for the "efficiency" method, which is the preferred method.

(Area of Company's Space ÷ Total Building Area) x Total Building Electricity Use ÷ Building Occupancy Rate = Approximate kWh or MWh Electricity Used

To use Worksheet 2, follow the steps below:

1. Enter activity data for the annual electricity used in building in kWh in column A. If the activity data that has been collected is not in kWh, use the conversion factor worksheet to convert to kWh.
2. Enter the total area of the building in column B. It is important to use the same measurement unit in column B as used in column C.
3. Enter the area of the company's space in column C. It is important to use the same measurement unit in column C as used in column B.
4. Enter the building occupancy rate in column D. For example, if 75 percent of the building is occupied, enter .75 in column D.
5. In column E, an estimate of the annual electricity used by the company is automatically calculated in kWh.
6. Enter the appropriate CO_2 emission factor in column F. Note that the emission factor should be entered as grams CO_2/kWh. If the emission factor selected is not in grams CO_2/kWh, use the conversion factor worksheet to convert to grams CO_2/kWh.
7. In column G, an estimate of the company's annual CO_2 emissions in metric tones of CO_2 is automatically calculated.
8. All values in column G are automatically added to provide a total CO_2 emissions value in metric tons of CO_2.

V. Quality control of calculations

To identify calculation errors and omissions, it is recommended to follow general guidelines provided in Chapter 7 (Managing Inventory Quality) of the Corporate Standard for implementing a quality assurance process for all emission estimates.

Uncertainty Assessment
There are two key sources of uncertainty – activity data and emission factors – when estimating CO_2 emissions from the consumption of purchased electricity, heat, and/or steam.

Uncertainty relating to the collection of activity data for electricity, heat, and/or steam use often depends on data availability. If actual electricity or fuel use records are available, then uncertainty relating to the collection of activity data will be significantly less then if these records are not available, in which case a more inaccurate estimation method using default data may be necessary.

Uncertainty surrounding emission factors is mainly due to the accuracy in which they are measured, and the variability in the supply source. For example, emission factors for coal vary greatly, depending on its characteristics and chemical properties. Therefore, using international default carbon content coefficient for coal may result in a more uncertain estimate than for other fuels.

A calculation tool and guidance on the quantification of uncertainty is available on the GHG Protocol Initiative website, www.ghgprotocol.org.

VI. Reporting and documentation

In order to ensure that estimates are verifiable, the following documentation should be maintained. This information should be collected for auditing and certification purposes, but is not required to be reported or provided.

Data	Documentation Source
Electricity, heat, and/or steam purchase and consumption data	Purchase receipts, delivery receipts, contract purchase or firm purchase records, electricity bills, metered electricity documentation
Emission factors used other than defaults provided	Purchase receipts; delivery receipts; contract purchase or firm purchase records; IPCC, IEA, national or industry reports, test reports
All assumptions made in estimating electricity, heat, and/or steam consumption and emission factors	All applicable sources

Guidance on external reporting is provided in Chapter 9 (Reporting GHG Emissions) of the Corporate Standard.

VII. References

CSA Climate Change (2005), Canadian GHG Challenge Registry.

CCAR (2004), Appendix X to the General Reporting Protocol: Power/Utility Reporting Protocol

EIA (2001), Voluntary Reporting of Greenhouse Gases, Form EIA-1605, US Department of Energy

EIA (2000), Annual Energy Review, US Department of Energy

IEA (2000), CO2 Emissions from Fuel Combustion

IPCC (1996a), Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Greenhouse Gas Inventory Reporting Instructions

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UK DETR (1999), *Environmental Reporting - Guidelines for Company Reporting on Greenhouse Gas Emissions*, Department of the Environment, Transport and the Regions: London

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UNEP (2000), The GHG Indicator, UNEP Guidelines for Calculating GHG Emissions from Businesses and Non-Commercial Organizations

US EPA (2004), Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance for Indirect Emissions from Purchases/Sales of Electricity and Steam

US EPA (2005), Climate Leaders Greenhouse Gas Inventory Protocol Design Principles

US EPA (2002), Emissions & Generation Resource Integrated Database (eGRID)

VIII. Acknowledgements

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 While the guidelines are largely self-explanatory, for questions or suggestions on its contents, please contact Pankaj Bhatia at pankaj@wri.org or Florence Daviet at fdaviet@wri.org.

Please visit the GHG Protocol Initiative website, www.ghgprotocol.org, for other GHG calculation tools.