# Sustainable Games Standard

# Scope 3, Category 9 GHG emissions

# Downstream Transport and Distribution

# (Game installs and updates)

VERSION: 0.1.0

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# Top-level summary

| | |
|---|---|
| Emissions from: | • Downloads of game install files transported via the internet<br>• Downloads of game updates transported via the internet<br>• End user device usage associated with downloads of game files (while game is not running)<br>• Associated end user CPE usage while downloading game files |
| Examples: | • Game install downloads from Steam, Apple App Store, and Google Play Store, etc<br>• Game install downloads for games from own-data centre (internet transmission only – see note below)<br>• Updates to games from third party distribution platforms<br>• Updates to games from owned-data centres (internet transmission only – see note below)<br>**Excludes**:<br>• Own data centre operations – reported under either: S3.1 / S3.4 for rented DC services, or Scope 2 for on-prem DC.<br>• End-user device energy & emissions for downloads that occur while the game is running. |
| Data sources: | • Internal build data (game file size)<br>• Internal build data (game updates file size)<br>• Regional emissions factors (SGA supplied)<br>• Average internet transfer speed - fixed/mobile connections (by country)<br>• Supplier specific DC energy efficiency data (or SGA supplied global fallback)<br>• Published internet infrastructure energy use (kWh/GB) |
| Data types: | • Data transfer quantity (GB)<br>• Average internet transfer speed per country (GB/s; MiB/s)<br>• Regional emissions factor (gCO2e/kWh) |

# Consult with other SGA resources

Understanding the requirements and nature of this component of the GHG emissions standard may be aided by consulting the relevant data input spreadsheet to see the overall structure and major sections before reading the standard specification.

# Overview

The SGA standard methodology for Scope 3 Category 9 "Downstream Transport and Distribution (Game installs and updates)" aims to interpret and improve upon the baseline GHG Protocol guidance, clarifying system boundaries and methods for measuring digital download emissions. The GHG Protocol specifies that S3.9 should include the transport of sold products *not paid for by the reporting company*. For the majority of game companies, game distribution is increasingly via digital downloads from the servers of digital distribution platforms (Steam, App Store, Google Store, PSNetwork, etc).

The current iteration of the SGA Standard is limited to the transport and distribution of digital game files, and does not provide measurement of downstream transport and distribution of physical game media. For assistance with physical games media sales, contact platform partners.

The GHG Protocol allows companies to use "either the fuel-based, distance-based or spend-based method" for downstream transport and distribution; however, digital downloads use electricity, and do not scale by distance travelled, or by spend. An electricity-as-fuel-based method is permitted, with GHG Protocol including guidance for transport via electric vehicles. The S3.9 downstream transport and distribution component of the SGA GHG Standard, therefore, adopts a method to measure the electrical energy consumption of the components of the digital distribution transport network that transfers games from producers to distributors, and eventually to the end consumers.

The initial upload of game files to a digital distribution platform is taken to be negligible and a non-material component of the downstream transport. Distribution from digital platforms to end users, including the operation of data centre servers, internet backbone, access/edge networks, and end user devices, is considered (with certain exceptions) to be material.

In this part of the SGA standard, a single method is permitted with three components:

- **Component A** is a required component, covering the use case of initial game installs. System boundaries in Component A include data centre/edge server processing energy consumption and internet backbone and access network energy consumption.

- **Component B** is a required component, covering the use case of data downloaded for game updates, with identical system boundaries.

- **Component C** is an *optional* component and is only required *when specified material thresholds are reached* in either total player count or game file size.

**NOTE**: Currently, the SGA Standard for S3.9 downstream transport and distribution thresholds for materiality of end user devices are initial best estimates and require real-world validation and feedback from implementers.

The current methodology supports initiatives to reduce S3.9 'downstream transport and distribution' emissions, such as efficiently packed and optimised game downloads and updates. Similarly, due to a lack of transparent data from suppliers, average energy intensity metrics are permitted and provided by the SGA in several places, however the Standard aims to encourage and support supplier direct engagements and simple data requests to encourage transparent disclosures of intensity from digital distribution platforms.

# Specification

Users shall employ the following methods to measure the electricity consumption and greenhouse gas emissions arising from digital downloads of game files, when they are downloaded from a third-party distribution platform (Steam, Apple App Store, PSNetwork, etc), corresponding to GHG Protocol Scope 3, Category 9 "Downstream Transport and Distribution". Due to the 'bundled' nature of energy consumed by internet infrastructure, its

highly efficient nature, and its far removed from access by reporting companies, direct measurement of emissions in this category shall not be required, with estimation derived from best available proxies, informed by the latest research, and supplier engagements with digital platform partners.

There are three components to calculations permitted as in this part of the standard.

**Component A** estimates energy consumption of internet infrastructure (core and access networks) and data centre delivery of files to end users by using the most recent available figures for energy intensity of data transfer across the global internet (kWh/GB) during the reporting period, applied to the initial install of game files, and either a supplier specific intensity figure or an applicable average.

**Component B** estimates the energy consumption during the reporting period of the same internet infrastructure and data centre file delivery, applying the same method as in Component A, however it is applied to the downloading of game update files, patches, or content delivery that occurs between digital distribution platforms and end users (data transfers from owned/controlled data centres such as in-game content downloads are to be measured in the S3.1 data centre component of this standard).

**Component C** estimates the energy consumption of end-user devices and customer premise equipment (CPE – routers/modems, etc) while downloading *all* game files (combining install and updates) during the reporting period – for all data downloads that occur *outside* the game being active (to avoid double counting with S3.11 'Use of sold products'). Component C combines the two install/update use cases into a single total data amount downloaded for each device/platform/region, and is only required for games of either a sufficiently large file size or a sufficiently large player base where it may be material.

## Basic game and other settings used in this part of the standard:

- Name of the game

- File size of download for installation (GB)

- File size of update(s)

- Internet data transmission energy intensity rate (kWh/GB) using the best available research

- Data centre file delivery processing energy intensity (kWh/GB), either from supplier engagement & disclosure or a conservative global average

- Average internet transfer rate (fixed internet) per region

- Average internet transfer rate (mobile internet) per region

- Total downloads (install and update) per platform, per region

## Component A – Game Installs – Estimated energy consumption and GHG emissions of internet infrastructure and data centres from the download of game files for install, aggregated by region

Users of the standard shall collect data on the number of installs of games in each region (country level minimum), either via the digital distribution platform the game is sold and distributed through (e.g: Steam, Apple App Store, Unreal Store, Itch, GOG.com, etc) or via other internally collected metrics built into the game.

To measure the total number of downloads, the output of the digital distribution platform's metrics regarding the "total downloads" or similar "total install count" shall be considered an acceptable data source. Future iterations of this standard shall consider data quality requirements for specific platforms (e.g. inclusion/exclusion of refunds, multiple installs,

re-installs, etc, and how they may be handled by platforms) after further consultation and evaluation.

Alongside this, users are to collect data on the total size (in Gigabytes) of game downloads from each digital distribution platform, either by starting a download and observing the total size transferred, or by using the total installed file size of game when installed (keeping in mind that the "packed" download file for install may be smaller than the installed files in a game directory, with a consequence being an over-estimate of energy use and emissions). In most cases, a single "game file install download" size will suffice for use across all regions, however in cases where there is a substantial difference in file size for a given region – for example due to localization such as additional or different language or audio files – an "override game file install download$_{region}$" regional filesize (in GB) is to be provided that reflects the size of the download in a given region and used to override the default, used in the calculations for that region.

Measurement of the energy consumption of internet backbone and access network from installs of games shall be calculated for each region, and consist of a simple multiplication of the number of installs (whole units) in a given region with the file size (GB) with the most relevant Internet energy intensity rate (kWh/GB):

Total install network energy consumption$_{Region}$ = Total installs$_{Region}$ . Game file install download$_{(default)}$ . Internet energy intensity rate

$$= 100{,}000_{(Installs\ in\ Finland)} . 90\ Gigabytes_{(default)} . 0.023$$

$$= 207{,}000.00\ kWh$$

Measurement of the energy consumption of data centres from processing and file transfer arising from game installs shall also be calculated for each region, and consist of a simple multiplication of the number of installs (whole units) in a given region with the file size (GB) with the most relevant data centre intensity metric (kWh/GB). Ideally, platform-specific DC

intensity metrics should be acquired and used from the digital distribution platform, however, in cases where such data is not available, a global average DC intensity, or other applicable estimate based on research shall be used.

Total install DC energy consumption$_{Region}$ = Total installs$_{Region}$ . Game file install download$_{(default)}$
. DC energy intensity rate

$$= 100{,}000_{(Installs\ in\ Finland)}\ .\ 90\ Gigabytes_{(default)}\ .\ 0.27733$$
$$= 2{,}495{,}970\ kWh$$

Calculation of the associated GHG emissions for a given energy consumption in each region shall use the most applicable electricity emissions factor for the reporting period (gCO2e/kWh), and be converted to tCO2e (by division by 1,000,000).

Total GHG emissions$_{Finland}$ = ( Total install network energy consumption$_{Finland}$ + Total install DC energy consumption ) . Finland EF$_{2024}$

$$= (\ 207{,}000\ kWh + 2{,}495{,}970\ kWh\ )\ x\ 79.16$$
$$= 213{,}967{,}105.2\ gCO2e$$
$$= 213.967\ tCO2e$$

The total GHG emissions from downloads of games files for install shall be a simple sum of all regions GHG emissions totals.

Example: Using the exported total downloads CSV file from Steam

For game downloads through the Steam platform, users are advised to follow the following series of steps to obtain data in a format usable with the standard.

1. Log into Steamworks with your account details
2. Navigate to Downloads by Region

3.  Set a custom date range that matches the reporting period (e.g. if reporting on calendar year, select Jan 1 – Dec 31)

4.  Select "View as CSV"

5.  In the CSV, data is shown in two sections: the top section "Region" is NOT TO BE USED to avoid double counting. The lower section "Country" and associated  "Total Downloads" are to be used to input data for this component of the standard.

6.  If specific game regions have a larger or smaller game file size than the default set in "Basic settings", you can input this alternative install file size in the OVERRIDE column; otherwise, leave blank

See the linked SGA [S3.9 Downstream Transport and Distribution data input sheet](#) for example use of Steam output data.

Example: Using the exported total downloads CSV file from App Stores

*** To be included in a future iteration ***

# Component B – Updates – Estimated energy consumption and GHG emissions of internet infrastructure and data centres from downloads of game updates, aggregated by region

To measure the energy and emissions of game updates, users of the standard are to collect data on the total number of updates over the reporting period, including the size of each update (or an average if update sizes are relatively consistent), and the number of downloads of each update. Exact numbers of downloads of each update shall be preferred where possible; however, in cases of low data availability, an MAU or other estimate of total active players and the likely associated downloads for each game update may be used.

Data is to be collected on a regional basis (country level minimum), either via the digital distribution platform the game is sold or distributed through (for example: Steam, Apple App Store, Unreal Store, Itch, GOG.com, etc) or via other internally collected metrics. Users of the standard may aggregate the total data amount for each region from all updates, or calculate each update individually. However when a large number of updates are made available over a reporting period, total aggregate data downloaded may be required for expediency. Users may use their own working out, or other automated solutions, to produce regional total data amounts.

From each subtotal, a regional total download energy consumption (kW) is to be calculated for each of the two system components (internet transmission networks, and data centres). Energy consumption of internet transmission networks is to be calculated via simple multiplication of the total data downloaded in updates (potentially as estimates via MAU, or users own working-out), and the internet infrastructure energy intensity metric (as used in Component A). Energy consumption of the data centre is to be calculated by simple multiplication of the total data downloaded in updates (potentially as estimates via MAU, or users own working-out), and the internet infrastructure energy intensity metric (as used in Component A).

Regional GHG emissions subtotals shall be calculated for each component (network and DC) by multiplying each regional energy consumption subtotal by the most appropriate grid emissions factor for the reporting period for that region. The sum of all regional GHG emissions subtotals for both network and DC components shall be the Component B (Updates) total and reportable as part of the S3.9 downstream transport and distribution total.

Example: Estimate of energy consumption of internet infrastructure from one update in one region

Game X has 100,000 players in Finland, with one update to the game released in the reporting period, downloaded by all players, with the file size of the update being 10 GB.

Update (network) subtotal energy consumption$_{Finland}$ = Update downloads$_{Finland}$ . Update file size$_{(GB)}$ . Internet energy intensity$_{(kWh/GB)}$

$$= 100,000_{(update\ downloads)} . 10\ Gigabytes . 0.023$$

$$= 23,000\ kWh$$

Update (network) subtotal GHG emissions$_{Finland}$ = Update (network) subtotal energy consumption$_{Finland}$ . Grid emissions factor$_{Finland}$

$$= 23,000\ (kWh)\ x\ 79.16\ (gCO2e/kWh)$$

$$= 1.82068\ (tCO2e)$$

Update (DC) subtotal energy consumption$_{Finland}$ = Update downloads$_{Finland}$ . Update file size$_{(GB)}$ . DC energy intensity$_{(kWh/GB)}$

$$= 100,000_{(update\ downloads)} . 10\ Gigabytes . 0.27733$$

$$= 277,330\ kWh$$

Update (DC) subtotal GHG emissions$_{Finland}$ = Update (DC) subtotal energy consumption$_{Finland}$ . Grid emissions factor$_{Finland}$

$$= 277,330\ kWh\ x\ 79.16\ gCO2e/kWh$$

$$= 21953442.8\ gCO2e$$

$$= 21.953\ tCO2e$$

Update (network + DC) energy consumption total$_{Finland}$ = Update network subtotal energy consumption$_{Finland}$ + Update DC subtotal energy consumption$_{Finland}$

$$= 23{,}000 \text{ kWh} + 277{,}330 \text{ kWh}$$

$$= 300{,}330 \text{ kWh}$$

Update (network + DC) subtotal GHG emissions$_{\text{Finland}}$ = 300,330 kWh x 79.16 gCO2e/kWh

$$= 23774122.8 \text{ gCO2e}$$

$$= 23.774 \text{ tCO2e}$$

# Component C – End user devices – Estimated energy consumption of end user devices across total game downloads and updates, aggregated by region

This component of the standard is **only required to be used in specific circumstances**: when game install and/or update file sizes are especially large, or when the total number of players is very substantial. Thresholds for the use of this component are provisionally:

- Game file sizes greater than 100GB
- Total player counts ›1 million for console/PC platforms; ›10 million for mobile platform releases

To measure the energy consumption and emissions of end user devices for the duration of downloads, users of the standard are to produce an aggregate figure representing a reasonable estimated total download amount (in GB) of all players in a given region and platform – ensuring to taking into account file downloads for both install and update in the reporting period.

**Note**: Do not include in this figure any data downloaded by players while the game is in operation (in-game downloads, multiplayer data, etc) to avoid double-counting with S3.11 'use of sold products'. Only downloads and updates that occur while the game itself is not running are to be included in Component C regional download totals.

For each region, an "average fixed internet download rate" and "average mobile internet download rate" are to be obtained (for example, from OOKLA data). These figures are to be used to estimate the total duration of device operation for the given quantity of downloads, for each given region and platform. This shall be done by dividing the total download figure per region by the average download rate (fixed for PC/console, mobile for mobile) in GB/s. Conversion from Mbps/s to GB/s may be required (by dividing the Mbps value by 0.000125. The result of this calculation is to be considered "total hours spent downloading" by all end users of each platform, and repeated for each region.

Users of the standard are then to produce a "user device total energy consumed per platform region" figure (in kWh) by multiplying the "total hours spent downloading" by the typical energy consumption amount for the corresponding platform: 5 Watts for mobile (7.5 Watts total), 30 Watts for console (32.5 Watts total), 100 Watts for PC (102.5 Watts total). To each of the corresponding platform energy consumption figures, an additional allowance of 2.5 watts is to be added to represent a portion of Customer Premises Equipment (CPE) usage.

**NOTE**: The current platform power usage figures are *provisional*, based on conservative estimates – further research is required to validate these figures in the real world. Additionally, future versions of this standard may consider a model of expected download method (fixed vs wireless) for each region and platform.

The "user device total energy consumed per platform region" is to be multiplied by the most appropriate emissions factor for the region to produce a "user device GHG emissions per platform region".

## Example: Estimating end users for one region

Game X is published on PC, console and mobile platforms. File sizes are approximately the same on each platform: 10 GB. There are no game updates downloaded during the reporting period.

| Basic settings › | Game file size | Region | Region EF (gCO2e/kWh) |
|---|---|---|---|
| | 10 GB | Finland | 79.16 |
| | | | |
| Platform | Mobile | Console | PC |
| Player totals for region (Finland) | 900,000 | 1,800,000 | 5,000,000 |
| Total data downloaded in region (GB) (Players in region x file size) | 9,000,000 GB | 18,000,000 GB | 50,000,000 GB |
| Avg internet speed for platform | 146.28 Mbps (0.018285 GB/s) | 150.41 Mbps (0.01880125 GB/s) | 150.41 Mbps (0.01880125 GB/s) |
| Est. time spent downloading (hrs) | 136,724.09 | 265,939.76 | 738,721.57 |
| Platform power assumption (W) | 5W (+ 2.5 W CPE) | 30W (+ 2.5 W CPE) | 100W (+ 2.5 W CPE) |
| Est. platform power consumption (kWh) | 1,025.43 | 8,643.04 | 75,718.96 |
| Est. platform GHG emissions (tCO2e) | 0.081 | 0.684 | 5.994 |

## Reportable total for S3.9

The sum of all "total GHG emissions per platform region" calculations is to be summed with Component A and Component B totals, and reported as the total GHG emissions from Scope 3.9 downstream transport and distribution emissions.